Advanced Stop Line Variations Research Study

Research Findings

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Glossary

Abbreviation	Definition
ACFL	Reservoir feeder lane
ASL	Advanced (cycle) stop line.
ATS	Automatic Traffic Signal
CCE	Cycling Centre of Excellence
DfT	Department for Transport
HGV	Heavy goods vehicles
LAJ	Lane Across Junction. This is a cycle lane usually located across a junction approach and painted green, with cycle symbols at regular intervals and delineated with an intermittent white line on both sides.
LAAU	London Accident Analysis Unit, now known as London Road Safety Unit
PTW	Powered Two Wheeler. These include motorcycles and scooters.
PWR	Part-width reservoir
TAL	Traffic Advisory Leaflet issued by the Department for Transport
TfL	Transport for London
TLRN	Transport for London Road Network
VCL	Virtual cycle lane
TSRGD	Traffic Signs Regulations and General Directions

1. Introduction

1.1 Atkins was commissioned by Transport for London (TfL) to carry out a research study into experimental cycle facilities at a number of signal-controlled junctions on the A202 and A23. The key area of study involved experimental variations of Advanced Stop Lines for cyclists (ASLs). These variations related to the ASL reservoir feeder lane and the layout of the reservoir itself, and are described in greater detail below.

VARIATION LAYOUTS

1.2 The conventional layout of an ASL reservoir covers the full width of the lane (or lanes) approaching the junction. This study looked at a variation of the reservoir whereby it covers just part of the approach and is known as a Part-Width Reservoir (PWR).

1.3 The conventional access to an ASL reservoir is via an advisory or mandatory feeder lane. If there is insufficient width to provide a feeder lane, a stub feeder lane or 'gate' can provide access into the ASL reservoir. This study looked at the use of coloured surfacing to denote an informal or 'Virtual' Cycle Lane (VCL) as a means of accessing the ASL reservoir.

1.4 The final feature which was included in the study does not directly relate to ASLs but can be used in conjunction with them. Referred to in this report as a 'lane across the junction' (LAJ), it involves the provision of a cycle lane (marked by two broken white lines) across the centre of a signalised junction. Conventionally, cycle lanes are not considered necessary across signalised junctions as traffic movements are controlled and potential conflict should be low. However, some junctions in London have large central areas and it is thought that a marked lane could provide cyclists with guidance and possibly reduce conflict.

2. Background to the Development and Use of Advanced Cycle Stop Lines in the UK

2.1 The following information relates to the background and development of ASLs and has been adapted from information provided by John Lee from the TfL Cycling Centre of Excellence.

INTRODUCTION

2.2 ASLs were first introduced into the UK in Oxford in 1986, primarily as a measure to increase safety for cyclists by enabling them to move in front of traffic queues at signal controlled junctions. The Department for Transport (DfT) has produced two Traffic Advisory Leaflets (TAL) on advanced stop lines: 'Advanced Stop Lines for Cyclists' TAL 8/93, and 'Further Development of Advanced Stop Lines', TAL 5/96.

2.3 It is generally accepted that ASLs are normally beneficial to cyclists for reasons including the following. They can:

- Make car drivers more aware of cyclists;
- Help right turning cyclists to position themselves correctly;
- Reduce cyclists' conflict with left turning motor vehicles;
- Enable cyclists to wait away from direct exhaust fumes;
- Give cyclists some priority over motor vehicles;
- Increase cyclists' comfort and belonging on the carriageway.

The Legal Situation

2.4 The regulations and layouts permitted for ASLs and lead-in lanes are contained within the Traffic Signs Regulations and General Directions (TSRGD) 2002. This was introduced in December 2002 and came into effect on 31 January 2003 for new schemes. The latter TSRGD is more restrictive than its predecessor in that the previous TSRGD 1994 included the (ASL) stop line marking but did not include specific restrictions on its use with feeder lanes. The TAL 8/93 and TAL5/96 gave guidance on ASL usage.

2.5 The present TSRGD 2002 regulations on the size of the ASL reservoir state that it must be 4.0 – 5.0m deep, as opposed to the original 3.0 – 5.0m.

2.6 At present, part-width ASLs, gate and stub feeder lanes are non-conforming signs/markings unless authorised. DfT blanket approval is being sought by TfL/CCE, (as well as individual site authorisation for all A23 and A202 variations).

Summary of ASL Research/studies

2.7 Research on the effectiveness of ASLs is relatively limited. A summary of known completed and in-progress ASL related studies follows:

TRL Project Report 181 – Reviewed six of the first ASL sites (Reported in TAL 5/96)

- ASLs were found to be working in a satisfactory manner.
- Cycle reservoir recommended to be 4.0 –5.0m deep.
- Coloured surface helped reduce encroachment.

TRL Report 585 – 'Capacity Implications of ASLs for cyclists', including lead-in lanes shows:

- Capacity of junction is not significantly affected so long as the number of general vehicle approach lanes is maintained.
- Small variations in signal inter-green timings may be required when ASLs are added, (1-2 seconds maximum).
- If a lead-in lane removes a general vehicle lane then the junction capacity could result in a reduction of as much as 50% depending on the previous amount of reserve capacity and the number of lanes, and feed-in lanes.

TfL LAAU[1] – Study (2001) of a number of ASLs for accident levels before and after their implementation.

2.8 There was no published report, but the study showed:

- No significant overall accident saving to cyclists after the provision of ASLs at about 50 sites in London, although there were reductions at some individual sites.

2.9 Follow-up studies were suggested to determine any characteristics of ASLs or their locations that were beneficial or otherwise.

TRL (for TfL LAAU) – 'Behaviour at Cycle Advance Stop Lines', Study (in 2002-4) of 14 ASLs in London,

2.10 This study is not yet published, but shows:

- 36% of cyclists experienced encroachment into the ASL reservoir while they were using it;
- 18% of cyclists jump red lights;
- 87% usage of near-side feeder lanes;
- 52% usage of central feeder lanes;
- most cyclists reach ASLs whether or not there are feeder lanes; and
- Feeder lane was blocked for 6% of cyclists.

[1] LAAU refers to the London Accident Analysis Unit, which is now known as the London Road Safety Unit (LRSU)

Faber Maunsell (for TfL CCE 2004) – 'Before and After Study' of the implemented A23 and A202 ASLs.

2.11 TfL Cycling Centre of Excellence (CCE) are also currently working with Faber Maunsell on a before and after study of the implementation of a programme of ASLs on the A23 and A202 in Croydon, Lambeth, Westminster and Southwark.

2.12 This study examined:

- journey times along the route for cyclists;
- accident records;
- user opinion on general and specific aspects.

LATEST DESIGN DEVELOPMENT AND IMPLEMENTATION

2.13 A large variety of ASL layouts have been used since their initial implementation nearly twenty years ago. Some of the layouts have been included within the TSRGD 2002 approved layouts whilst others have not. Variations in the standard layouts have been widely developed over the years, mainly to deal with individual junction characteristics.

2.14 Recent developments of ASLs in London include the trial implementation of the following (see Figure 2.1 for example layouts):

Part Width Reservoirs

2.15 These are characterised by a part-width ASL reservoir across the carriageway (with the offside portion omitted) and are implemented where there are multiple traffic lanes and no right turn. These part-width ASLs have been used at a number of locations over many years prior to them being designated non-conforming' by the amendments in TSRGD 2002. Specific known locations are: Old Street roundabout (2002), Station Road, Harrow (1997), Vauxhall Cross gyratory (2003). No known problems exist with the part-width ASLs at these locations. Also see 'Cycle-Friendly Infrastructure' page 60 – picture and quote *'In some situations, it may be more appropriate to stagger the stop lines*'. Although this may not include a formal ASL as such, just an advanced stop line to a cycle lane, this type of layout is used in many locations outside London. The benefits for cyclists are considered to be:

- Lower levels of vehicle encroachment beyond the first stop line;
- Less space needed to implement ASLs, particularly on right-hand bends; and
- Discouragement of unsafe cycling manoeuvres in the off-side of the carriageway when they are not necessary, (i.e. where no right turn exists).

Reservoir access gates or stub feeder lanes:

2.16 Gates provide legal access to reservoirs by way of a diagonal access marking (to TSRGD Diag 1009). They are implemented where the carriageway width is too restricted to provide standard advisory or mandatory feeder lanes, (TfL agree a minimum lane width of 2.5m adjacent to an advisory cycle lane, and a minimum lane width of 3.0m adjacent to mandatory lane). Stubs are very short feeder lanes (in the order of a few metres. These are similar to advisory cycle lanes, being coloured (deep chrome green) with TSRGD Diag 1057 cycle symbols, but have no TSRGD Diag 1004 white lane markings. Stub lanes and access gates have been used at numerous sites for many years at ASLs where it has not been possible to incorporate proper feeder lanes. Note: full feeder lanes should normally be provided where this is possible.

Coloured surfacing in lieu of cycle lanes

2.17 Coloured surfacing has been used in a variety of situations without cycle lane markings. These provide general guidance for cyclists to show continuity of route and to help warn motorists (in conjunction with 1057 cycle symbols). The expected benefits are a raised awareness by motorists of cyclists, with the consequent reduced conflicts and accidents. Also, clearer guidance and encouragement for cyclists on the carriageway:

- Where lane widths are insufficient to permit an advisory or mandatory cycle lane a VCL provides guidance on the approach to a junction.
- As an informal cycle lane under zigzags at zebra crossings, this is now common practice.
- As guidance across junctions without markings (mainly prior to acceptance of advisory cycle lane markings across priority junctions).

Cycle lanes across signal controlled junctions

2.18 These cycle lanes are characterised by TSRGD Diag 1010 broken white line markings, TSRGD Diag 1057 cycle symbols and coloured surfacing. They are intended to help improve safety and guidance for cyclists travelling straight through the junction, particularly where junctions are wide and may change in width and alignment. Cycle lanes have been used in many junction situations including:

- side-road junctions since about 1996;
- roundabouts, although this practice is generally discouraged except in some instances (York ‘magic roundabout’ etc);
- the Forest Road/ Blackhorse Road junction at Waltham Forest London since 1999
- Dublin across signal controlled junctions (since 2000) and more recently in London.

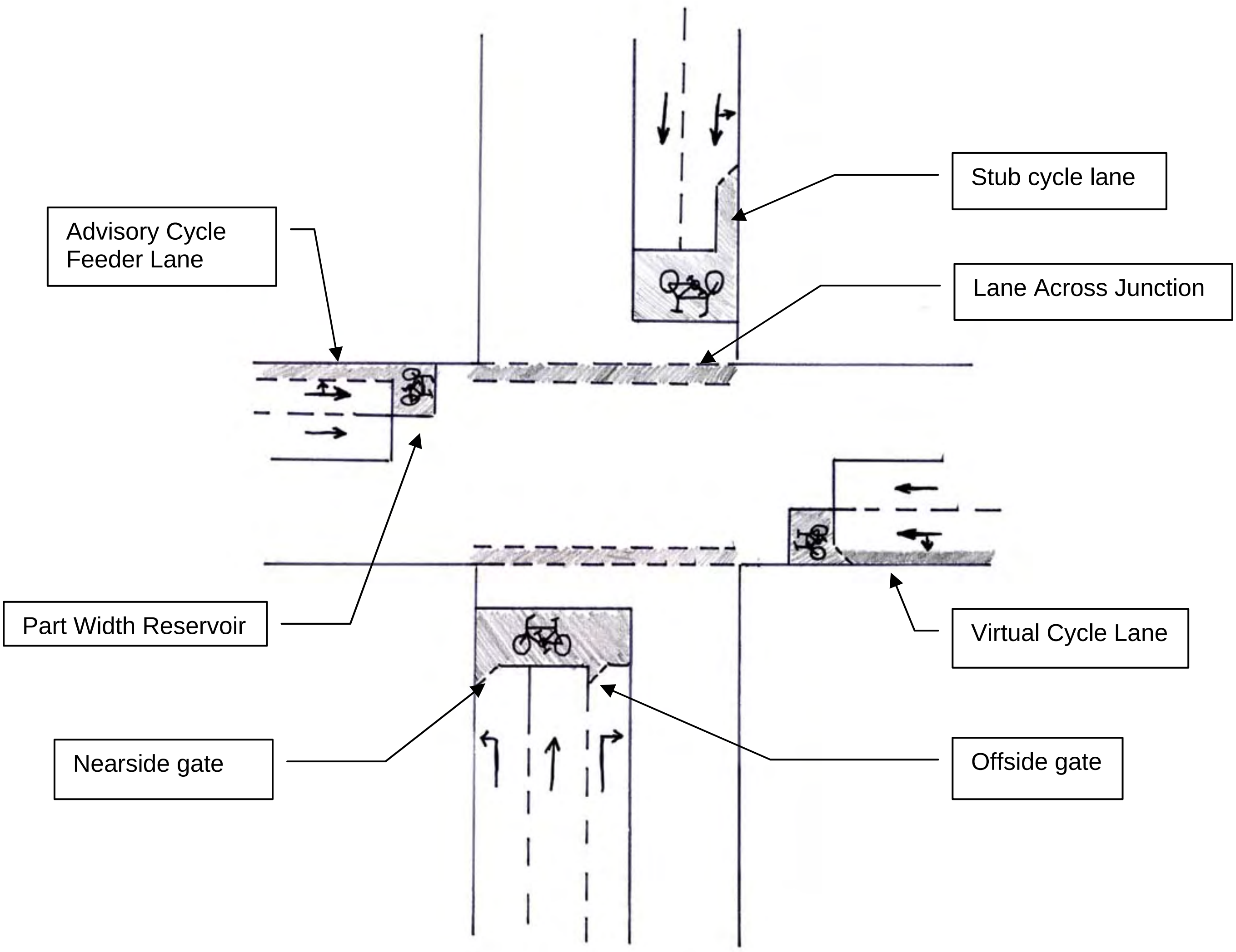


Figure 2.1 – Examples Cycle Features

PURPOSE OF ASL VARIATIONS

2.19 The above measures are intended to:

- provide or improve cyclist priority at signal controlled junctions;
- provide better access to ASL reservoirs;
- improve motorist compliance at ASLs;
- guide cyclists in their use of road space, and;
- raise motorist awareness of cyclists.

A23 and A202 ASL Works, and 'Before and After' Study

2.20 As referred to above, the A23 and A202 have now been treated with these measures. The decision to implement the measures was made by TfL who received advice from their consultant. Sites were identified where it was thought that the new measures would be useful and unlikely to cause problems. Narrow lanes and a lack of space precluded certain junctions from being treated with the measures.

2.21 The scheme included over thirty junctions and one hundred separate ASL reservoirs. However, not all junctions contained each measure. The lengths of roads in question were the A23 from The Oval via Brixton and Streatham to Purley, and the A202 from Victoria to New Cross via Vauxhall and Peckham. Construction took place from March to September 2004.

3. Methodology

DATA COLLECTION

3.1 The key data collection exercise for this research was the recording of video footage at 10 selected sites. TfL requested that video cameras or CCTV should be used to collect this data. After checking the location of TfL's own CCTV cameras it was decided that dedicated video surveys would be required to collect the data.

Study Brief

3.2 The study brief was set out as follows:

3.3 The selection of junctions will ensure a reasonable balance of measures, junction types and road conditions.

3.4 Video footage of junctions will enable the relevant data to be collected on numbers using facilities, vehicle encroachment and conflict issues. There will be a coverage of at least 24 hours at each site, with proposed times including both 7am to 7pm on one day, and the morning and evening peaks (7.30 to 9.30am and 4.0 to 6.00pm) on at least two days.

3.5 The consultant will conduct the study in such a way that all factors are taken into account for the analysis of data, for example time of day/day of the week data is collected, type of junction used, location of junction.

3.6 A sample size of 10 junctions is to be used, including two control sites. Most junctions will incorporate more than one of the facilities, for example one junction may have a part width ASL, stub feeder lane or access gate and coloured surfacing. Junctions will be categorised into different types, for example single, double or triple lane entry; and separate left-turn lane, and no right turns.

3.7 The number and type of junctions used will be sufficient to gain a good understanding of what is happening at different junction layouts and to help minimise anomalies such as abnormal or high conflict junctions. Appropriate site selection is key to the collection of relevant and usable data. This will ensure that individual features and combinations chosen will be adequately studied. The control sites are to be standard layout ASLs.

3.8 The findings of this research will then feed back into the design standards for ASLs and other junction measures for cyclists.

SITE SELECTION

3.9 Atkins was initially presented with approximately 100 potential sites. However, many of these were excluded for one or more of the following reasons:

- The VCL was less than 10m long;

- The approach was on a bend as vehicles may be more likely to stray into the cycle lane;
- The VCL left less than 1.8m for motor vehicles (as relatively few cars are narrower than 1.8m);
- The LAJ did not extend to the exit-arm pinch point (we wanted to establish whether the LAJ provides protection at this point);
- There was an unusual junction layout which might influence the transferability of the results.

3.10 A series of assumptions was put together to guide the research methodology and facilitate the final site selection process. Table 3.1 summarises the assumptions regarding encroachment, conflict, access and capacity.

3.11 The control sites used to assess the assumptions are shown along with any factors that needed to be considered.

Table 3.1 – Assumptions Assessed within this Study

Assumptions	Control Sites	Test Sites	Factors
Part Width Reservoirs			
a) Higher cycle flows may reduce vehicle encroachment into PWRs		6 10	Peak hour compared with off peak period
b) PWR results in less encroachment than standard ASLs	4, 5, 7, 8, 9	1, 2, 6, 10, 3 (Non standard PWR)	With and without powered two wheelers (PTWs)
c) PWR provides insufficient cycle capacity in the reservoir where cycle flows are high	4, 5, 7, 8, 9	1, 2, 3, 6, 10	
Virtual Cycle Lanes			
d) Higher cycle flows may reduce vehicle encroachment into VCLs		6, 7	Peak hour compared with off peak period
e) Nearside lane width influences the level of encroachment into VCLs	4, 5, 7, 8, 9	1, 2, 3, 6, 10	With and without wide vehicles
f) HGVs increase the level of vehicle encroachment into VCLs	4, 5, 7, 8, 9	1, 2, 3, 6, 10	Adjust for lane width
Lane Across Junction			
g) LAJ reduces conflict at pinch points on exit arm	1, 3, 4, 5, 7, 9	2, 6, 8, 10	
Gate entries			
h) Access by gate is harder than by VCL	3	6, 10	

3.12 For the control sites, standard layout ASLs were selected where there was no right turn so that comparisons could be made with the part-width reservoir sites.

3.13 After site selection began, it became apparent that some sites were unsuitable for use due to a lack of a conveniently placed post for mounting the video camera.

FINAL SITE SELECTION

3.14 Table 3.2 lists the final 10 sites selected for the video analysis. The site locations are shown in Appendix A. The layout of all of the sites is shown in Appendix B.

Table 3.2 – Selected Sites with Attributes

Site	FM[2] Dwg No.	Route No.	Site name	Direction of approach traffic[3]	Number & type of approach lanes[4]	High or low cycle flow	Reservoir type	Feeder lane type	Feeder Lane Width	Nearside lane width	Total	LAJ?
1	03	A23	Brighton Road/ Old Lodge Lane	SW	Double SL,S	Low	PWR	VCL	1.2m	2.3m	3.5m	No
2	16	A23	Purley Way/ Commerce Way	NW	Triple SL,S,S	Low	PWR	Advisory	1.5m	2.8m	4.3m	Yes
3	20	A23	A23/Streatham Common	N	Double S,S	Low/ Med	PWR	Gate	N/A	3.0m	3.0m	No
4	23	A23	Streatham High Road/ Stanthorpe Road	W	Double SL,S	Low	Standard	Advisory	1.2m	2.9m	4.1m	No
5	12	A202	Camberwell New Road, Bolton Crescent	NW	Double S,S	High	Standard	Advisory	1.2m	2.45m	3.65m	No
6	06	A202	Peckham Road/ Wilson Road	W	Double SL,S	High	PWR	VCL	0.9m	2.2m	3.1m	Yes
7	07	A202	Camberwell Church Street/ Artichoke Place	E	Single	High	Standard	VCL	1.5m	4.4m	5.9m	Yes
8	16	A202	Vauxhall Bridge Road/Millbank	NE	Quadruple SL,S,SR,R	High	Standard	Advisory	1.2m	3.0m	4.2m	Yes
9	16	A202	Vauxhall Bridge Road/Millbank	NW	Quadruple SL,S,S,R	High	Standard	Advisory	1.0m	3.1m	4.1m	No
10	19	A202	Vauxhall Bridge Road/ Warwick Way	NW	Double SL,S	High	PWR	VCL	1.2m	1.8m	3.0m	Yes

[2] FM refers to Faber Maunsell, who provided the detailed design for the implementation of the cycle features
[3] Where SE refers to South-Eastbound traffic, etc
[4] Where S is a straight movement, L a left turn and R a right turn. SL/SR indicates that the lane permits both a straight ahead movement and a left/right turn.

REASONS FOR SITE SELECTION

3.15 Site 1 (Brighton Road/Old Lodge Lane) was selected because it was in a low cycle flow environment and contained both a part-width reservoir and a virtual feeder lane. The feeder lane and remaining lane width was relatively wide at 3.5m but less than the minimum required for an advisory cycle lane (3.7m).

3.16 Site 2 featured a lane across the junction and a part-width reservoir, and was in a low cycle flow area.

3.17 Site 3 was the final site to be selected. It was chosen because the inside lane was narrow enough for a virtual feeder lane (less than 3.5m) so it would provide a useful control site to show whether virtual feeder lanes have any influence on the positioning of motor vehicles and, therefore, cyclist amenity.

3.18 Site 4 was chosen because it had a standard layout ASL in a low cycle flow environment. It also had a ‘no right turn’ making it a suitable control site for part-width reservoirs.

3.19 Site 5 was chosen for the same reasons as Site 4 but in a high cycle flow environment.

3.20 Site 6 had a virtual feeder lane, a part width reservoir and a lane across the junction in a relatively high cycle flow environment.

3.21 Site 7 was chosen because it had one lane which was known to operate as two in busy periods. Studying this site would show the impact that the inclusion of a virtual feeder lane would have on this kind of junction arrangement.

3.22 Site 8 was chosen as it had a very long LAJ in a high cycle flow environment.

3.23 Site 9 acted as a control site for Site 8 i.e. it had a similar lane configuration but without an LAJ.

3.24 Site 10 incorporated all three facilities in a relatively high cycle flow environment. Although this was similar to Site 6, the lane dimensions were slightly different.

Length of the assessed roads

3.25 The length of road containing the A23 sites (sites 1-4) was eight miles (from Purley to Streatham). The length of road containing the A202 sites (5-10) was just 2.5 miles, from Camberwell to Westminster.

4. Accident Statistics Analysis

4.1 The following accident analysis was carried out to determine whether any potential sites had particular problems which could make them unsuitable for inclusion within the study. However, this analysis was not the key determinant for the site selection process as there were many other factors to include as discussed in the previous chapter.

4.2 The accident rates were calculated for all locations with a control or potential site using the 36 month accident data to November 2004, provided by TfL for this purpose. The total accident rates were compared with those provided in TfL, Levels of accident risk in greater London, Issue 9, January 2003. The intention of this exercise was to identify those sites that should be used with caution. Unusually low or high accident rates may indicate atypical conditions that should be considered when drawing comparisons between different locations.

4.3 The actual accident rate per year for each site was compared with the accident rate per Automatic Traffic Signal junction (ATS), the accident rate per kilometre of 'A class road' for the appropriate Local Authority as well as on TLRN roads in Greater London. The latter two were adjusted assuming 4 arms at each junction for a length of 50 metres each. That is the accident rate given was multiplied by 0.2 kilometres.

4.4 Eight sites with more than a whole number difference outside of the range provided by the appropriate ATS, TLRN and 'A-class road' accident rates were identified. Sites identified with a low accident rate were:

- Site 2, A23 Purley Way, Commerce Road, Drury Crescent;
- Site 3 Streatham High Road, Streatham Common South;
- Streatham High Road, Mitcham Lane, Tooting Bec; and
- Site 5 Camberwell New Road, Bolton Crescent.

4.5 Sites identified with a high accident rate were:

- Queens Road, Pomeroy Street, Lausanne Road;
- Peckham High Street, Bellenden Road;
- Sites 8 and 9 Vauxhall Bridge Road, Millbank; and
- Site 10 Vauxhall Bridge Road, Warwick Way, Rochester Row.

4.6 In addition, the proportion of pedal cycle accidents was compared for the sites in question against the typical figures for pedal cycles at ATS junctions and on TLRN roads. A significant level of error is introduced at sites with a low number of accidents, due to the random and rare nature of accidents. Therefore only those sites with more than 20 accidents were checked using this method. Only Site 22 was identified with more than 5% difference from the typical proportion of pedal cycle accidents.

4.7 Of the above sites, the following were selected for inclusion within the ASL project:

- Site 2 A23 Purley Way, Commerce Road, Drury Crescent;
- Site 3 Streatham High Road, Streatham Common South;
- Site 5 Camberwell New Road, Bolton Crescent.
- Sites 8 & 9 Vauxhall Bridge Road, Millbank; and
- Site 10 Vauxhall Bridge Road, Warwick Way, Rochester Row.

4.8 With an accident rate of 1, Site 2 falls just outside the minimum target of 1.26. The lower than expected accident rate could be influenced by the fact that Drury Crescent is one way and, therefore, the number of conflict points is reduced[5]. Commerce Way and Drury Crescent may also have lower than typical vehicle flows which may also be a contributory factor.

4.9 Site 3 could be expected to have a lower than usual accident rate for the area because the junction form is one major road, one minor road and one site access. Therefore, the bulk of the movements at the junction are likely to be straight through, resulting in fewer accidents. The junction is expected to still be representative as a PWR and VCL site. Lower than usual conflict is expected through the junction.

4.10 Site 5 could be expected to have a lower than usual accident rate for the area because it is comprised of one main road, a lesser road and one minor road. Furthermore, turning movements are restricted at the junction resulting in lower potential conflict points. The site can be expected to operate typically for the ASL and feeder lane. However the incidence of accidents resulting from turning movements within the junction should be lower than typical.

4.11 Site 8/9 could be expected to have a higher than usual accident rate for the area because the junction is a crossroads and each approach has four lanes. The junction, therefore, permits significantly more vehicles than is typical in Westminster. Consequently, the incidence of accidents should also be correspondingly high.

4.12 Site 10 required further accident analysis to establish the likely cause of the elevated 36 month accident record. Table 4.1 shows the key accident types for Site 10 and compares each type with the typical rates for ATS junctions in Westminster.

Table 4.1 – Site 10 Comparisons of Accident Rates

Accident Type	No. Accidents	% Accidents	Typical for Westminster
Pedestrian	5	24%	29.2%
Pedal Cycle	3	14%	11.3%
Wet	4	19%	18.4%
Dark	8	38%	34.4%
Right Turns	6	28%	18.5%

[5] 2001 TRL Report 510 *Accidents at junctions on one-way urban roads* found that at 4-arm junctions, both accident frequency and rate were substantially lower if there was a one-way arm.

4.13 The significant accident type at the junction appears to be accidents involving right turns. This may be the result of inappropriate signal timings, such as inadequate inter-green periods. This assumption has not been confirmed by review of signal timings.

4.14 Pedal cycles feature in slightly more accidents at Site 10 than is typical for Westminster. However, the difference is not significant and it is therefore reasonable to assume that the conflict data provided from this site is adequately representative to include within the ASL research study.

4.15 An appropriate approach to this site may be that it can be selected providing it is not the only example of a particular cycle feature. This will ensure appropriate data is obtained even if the conflict data for this site is unusually high. Review of the site should include consideration of whether the conflict data are high and if so, whether this is a result of the general nature of the site or the cycle features being assessed.

5. Site Observations and Encroachment Results

5.1 After the video analysts completed data entry for each site, comments were provided on how the junction and the cycle facilities in particular were operating. Any trends or unusual happenings were noted. These are provided in this section, site by site. A summary of the encroachment results is also provided in this section after the site descriptions and observations.

5.2 Three categories have been used in the reservoir encroachment tables; up to 25%, 25% to 50% and over 50%. These indicate the amount of the reservoir that is obscured by a motor vehicle. It is considered that, when a reservoir is encroached by up to 25%, the ASL still provides a good level of amenity to cyclists. When a reservoir is obscured by more than 50%, it is likely that its usefulness becomes greatly reduced.

5.3 The feeder lane table was also divided into three categories. It was considered that 'No or slight encroachment' enabled the lane to function well for cyclists. 'Up to a third' encroachment would enable cyclists to access the reservoir but would be likely to impact on their comfort and perceived safety. When encroachment exceeds a third, cyclists would be unable to access the reservoir via the feeder lane.

GENERAL FINDINGS

5.4 Table 5.1 summarises the daily number of cyclists, along with the maximum number of cyclists arriving in any hour, and the hour that that occurred. The influence of powered two wheelers (PTWs) is of interest in the context of high cycle flows. These are, therefore, also given in Table 5.1.

Table 5.1 – Cycle Flows and Peak Cycle Hours

Site	Average number of cyclists/day	Maximum hourly cycle flow	Hour of highest cycle flow	No. of PTWs during peak cycle hour
1	30	9	18:00-19:00	0
2	30	8	08:00-09:00	17
3	134	35	08:00-9:00	7
4	24	14	08:30-09:30	4
5	416	126	08:00-9:00	46
6	235	50	08:15-09:15	16
7	254	65	18:00-19:00	0
8	411	119	08:15-09:15	179
9	251	57	08:00-09:00	5
10	198	53	08:15-09:15	17

5.5 As expected, the high cycle flow sites were those that were closer to Central London. These had over ten times the number of cyclists as the peripheral sites on the A23.

5.6 The highest cycle flows were in the peak hour corresponding to the direction of the predominant flow i.e. the inbound sites had higher flows in the morning peak and the outbound sites had higher flows in the evening peak.

5.7 The maximum hourly cycle flows ranged from 6 to 126. Site 8 had the highest hourly cycle flow.

5.8 Table 5.2 shows the average number of cyclists at each site for both days of data. It also describes how cyclists approached the junction and where/whether they stopped when arriving at a red signal.

Table 5.2 – Cycle Flows and Behaviour

Site	Average daily number of cyclists	Number arriving during red signal & % of No. of cyclists	Percentage[6] that stop in the reservoir	Percentage[6] that stop beyond reservoir	Percentage[6] that ignore red signal
1	30	9 (31%)	28%	55%	17%
2	30	10 (34%)	20%	25%	55%
3	134	35.5 (26%)	28%	34%	38%
4	24	20 (83%)	27%	51%	22%
5	416	182 (44%)	22%	18.6%	59%
6	235	74 (29%)	6%	33%	60%
7	254	59 (23%)	24%	10%	66%
8	411	311 (76%)	33%	60%	7%
9	251	125 (49%)	36%	34%	30%
10	199	98 (50%)	20%	47%	33%
Average for all sites	**198**	**44%**	**24%**	**37%**	**39%**

5.9 The percentage of cyclists arriving during a red signal ranged from 26% to 83%. Red light violation ranged from 7% to 66%, with an average of 39%.

5.10 Of all cyclists arriving at the junctions in a red phase, an average of 24% used the ASL correctly and waited in the reservoir. 37% waited beyond the stop line.

5.11 Table 5.3 and Table 5.4 provide a summary of the encroachment results for all of the sites. These are discussed in further detail in 7.

[6] Of cyclists arriving during the red signal over the two days

5.12 Table 5.3 shows the proportion of vehicles that encroached into the reservoir by up to 25% of the reservoir length. Therefore, a high proportion of vehicles encroaching to this degree indicates that the reservoir was more frequently available for cyclists to use. In other words, the higher the percentage of vehicles encroaching by 25% or less, the better for cyclists.

Table 5.3 – Summary of Vehicles Encroaching up to 25% into the Reservoir

Site	Reservoir type	All vehicles	Without powered 2 wheelers	All vehicles: peak hour	Without powered 2 wheelers: peak hour	All vehicles: off peak time	Without powered 2 wheelers: off peak
1	PWR	68%	69.1%	82.2%	83.6%	85.3%	76.8%
2	PWR	91%	94%	92%	97.18%	92.2%	93.7%
3	Non-standard PWR	46%	50%	32.%	36.4%	51%	52.2%
4	Standard	71%	72.5%	71.6%	74.8%	76%	76.2%
5	Standard	66%	75.8%	56.4%	75%	79.9%	86%
6	PWR	78%	80.5%	82.3%	92.2%	81.5%	82.4%
7	Standard	69%	72.8%	63.5%	65.9%	70.4%	74.2%
8	Standard	67%	88.1%	47.5%	88.4%	78.9%	89.6%
9	Standard	78%	80.2%	89.9%	93.9%	85.7%	88.6%
10	PWR	72%	79.8%	62.4%	75.7%	77.2%	81.8%

5.13 Similar to Table 5.3, Table 5.4 shows the proportion of vehicles that encroached by up to 33% of the feeder-lane width. A high proportion of vehicles encroaching to this degree, therefore, indicates that the feeder lane was more frequently available for cyclists to use.

Table 5.4 – Summary of Feeder Lane Encroachment

Site	Feeder Lane Type	VCL or ACFL width	Nearside lane width	Combined	Percentage of vehicles. encroaching ≤ ⅓ of feeder lane					
					All day		Peak hour		Off peak	
					All vehs.	Excl. wide vehs	All vehs.	Excl. wide vehs.	All vehs.	Excl. wide vehs.
1	VCL	1.2m	2.3m	3.5m	100%	100%	100%	100%	100%	100%
2	ACFL	1.5m	2.8m	4.3m	100%	100%	100%	100%	100%	100%
3	Stub	0m	3.0m	3.0m	-	-	-	-	-	-
4	ACFL	1.2m	2.9m	4.1m	99%	100%	100%	100%	100%	100%

Site	Feeder Lane Type	VCL or ACFL width	Nearside lane width	Combined	Percentage of vehicles. encroaching ≤ ⅓ of feeder lane					
					All day		Peak hour		Off peak	
					All vehs.	Excl. wide vehs	All vehs.	Excl. wide vehs.	All vehs.	Excl. wide vehs.
5	ACFL	1.2m	2.45m	3.65 m	80%	98%	50%	100%	85%	100%
6	VCL	0.9m	2.2m	3.1m	51%	86%	66%	100%	51%	84%
7	VCL	1.5m	4.4m	5.9m	97%	97%	100%	100%	97%	97%
8	ACFL	1.0m	3.1m	4.1m	99%	99%	97%	97%	99%	100%
9	ACFL	1.2m	3.0m	4.2m	98%	99%	100%	100%	98%	97%
10	VCL	1.2m	1.8m	3.0m	73%	93%	74%	88%	72%	98%

5.14 The remainder of this section discusses the results for each of the sites individually. The results are then compared and discussed in 7.

SITE 1: A23 BRIGHTON RD/ OLD LODGE LANE (SOUTHEAST BOUND)

Junction Layout

Figure 5.1 – Photo of Site 1

5.15 The site is the southeast bound approach of a T-junction (the top right bar of the T).

5.16 The site has a virtual cycle lane (VCL) and a part-width reservoir (PWR) on the nearside lane.

Visibility and Weather

5.17 The weather during the two days of videoing was cloudy with sunny patches throughout the day.

5.18 The camera was located in a good position so that visibility of the entire feeder lane was possible.

5.19 The reflective road surface made judging reservoir encroachment difficult during the hours of darkness due to glare and reflection caused by vehicle headlights.

Traffic Impact on Cyclist Level of Service

5.20 Most motor vehicles appeared to remain outside of the feeder lane throughout the day with the exception of motor bikes.

5.21 HGVs and buses appeared to be unable to avoid slight encroachment onto the feeder lane. At times this completely blocked the feeder lane.

Cyclist Behaviour

5.22 60 cyclists were observed during the two days of video footage. No unusual cyclist movements were observed.

Other Traffic

5.23 PTWs made considerable use of the feeder lane.

Table 5.5 – Site 1 Reservoir Encroachment

Degree of encroachment[7]	Car/van	HGV/ bus	PTW	Total
Up to 25%	71%	56%	34%	68%
25% to 50%	8%	13%	20%	9%
Over 50%	22%	32%	46%	24%
Total	**852**	**96**	**32**	**981**

5.24 This table shows that cars had the lowest level of encroachment. The large majority (71%) kept out of most of the reservoir. PTWs had the highest level of encroachment with only a third using up less than 25% of the reservoir.

[7] Refer paragraph 5.2 for an explanation of these categories.

Table 5.6 – Site 1 Feeder Lane Encroachment

Degree of encroachment	Car/van	HGV/bus	Total
No or slight encroachment	99%	75%	97%
Up to a third	1%	24%	3%
More than a third (lane effectively blocked)	0%	1%	0%
Total	**685**	**60**	**745**

5.25 Feeder lane encroachment was generally very low. Nearly all cars (99%) had either no or minimal encroachment. The majority (75%) of HGVs/buses also had minimal encroachment into the feeder lane.

Table 5.7 – Site 1 Cyclist Information

	Daily number of cyclists	Passed through in green phase	Arrived in red phase	Stopped in reservoir	Stopped beyond reservoir	Ignored red light
Average no.	29.5	20.5	9	2.5	5	1.5
Percentage	-	69%[8]	31%[9]	28%[10]	55%[11]	17%[12]

5.26 Cycle flows were low at this site averaging just 30 per day. Most cyclists arrived in the green phase. Of those arriving in the red, just 28% used the ASL correctly (waited in the reservoir). Over half stopped beyond the cycle stop line and 17% went through the red light.

[8] Percentage of average daily number of cyclists
[9] Percentage of average daily number of cyclists
[10] Percentage of cyclists arriving in red phase
[11] Percentage of cyclists arriving in red phase
[12] Percentage of cyclists arriving in red phase

SITE 2: A23 PURLEY WAY/COMMERCE WAY (NORTHBOUND)

Figure 5.2 – Photo of Site 2

Junction Layout

5.27 This site is the northern approach of a four arm junction. There is a LAJ and a conventional (advisory) feeder lane. Purley Way has three lanes; two are ahead only and one lane is a combined left turn and straight on. Purley Way is a main road.

5.28 There is a part-width reservoir (PWR) extending across the first of the three approach lanes.

Visibility and Weather

5.29 The weather during the two days of videoing was dry and sunny at times.

5.30 The size of the junction and the need to include the LAJ meant that the camera was some distance from the reservoir.

5.31 Judgement of the level of encroachment on the reservoir became an issue during the hours of darkness, as the car headlights would produce considerable glare on the screen.

Traffic Impact on Cyclist Level of Service

5.32 Motor vehicles turning left, especially long vehicles often got stuck on the corner whilst turning, when there was a traffic build-up on Drury Crescent. This movement would then block lane one, the feeder lane and the LAJ, which prevented cyclists from travelling across the junction for a short time.

5.33 There was some encroachment into the LAJ from vehicles, mainly HGVs and buses. However, due to low flows, cyclists were not affected.

Cyclist Behaviour

5.34 Many of the reported cyclists travelled during the green phase and used the LAJ as normal. A few ignored the traffic signals and crossed the junction in stages. Some would travel to the middle of the island and wait, before proceeding when a gap appeared in the next approach.

Other Traffic

5.35 The number of motorcyclists using the reservoir was far less than at other sites possibly due to the lower levels of PTW activity in this area.

Table 5.8 – Site 2 Reservoir Encroachment

Degree of encroachment[13]	Car/van	HGV/ bus	PTW	Total
Up to 25%	94%	83%	49%	91%
25% to 50%	3%	5%	14%	3%
Over 50%	3%	12%	37%	5%
Total	**1172**	**65**	**71**	**1308**

5.36 Over 90% of all vehicles kept out of (most of) the reservoir. Cars had the lowest encroachment and PTW the highest (just over half encroached by more than 25%).

Table 5.9 – Site 2 Feeder Lane Encroachment

Degree of encroachment	Car/van	HGV/bus	Total
No or slight encroachment	100%	93%	99%
Up to a third	0%	7%	1%
More than a third (lane effectively blocked)	0%	0%	0%
Total	**1371**	**132**	**1503**

5.37 The feeder lane was well observed with 99% of all vehicles encroaching only slightly, if at all. Over 90% of HGVs and buses had low levels of encroachment and 0% of all vehicles blocked the lane sufficiently to prevent its use by cyclists.

[13] Refer paragraph 5.2 for an explanation of these categories.

Table 5.10 – Site 2 Cyclist Information[14]

	Daily number of cyclists	Passed through in green phase	Arrived in Red Phase	Stopped in reservoir	Stopped beyond reservoir	Ignored red light
Average No.	29.5	19.5	10	2	2.5	5.5
Percentage	-	66%	34%	20%	25%	55%

5.38 Cycle flows were low averaging just under 30 per day. Most went through the junction on green. Of the 34% who arrived in a red phase, 20% used the ASL correctly, 25% stopped beyond the reservoir and over half ignored the red signal.

SITE 3: A23/STREATHAM COMMON SOUTH (NORTHBOUND)

Figure 5.3 – Photo of Site 3

Junction Layout

5.39 The selected arm was the northern approach (A23) at this four arm junction

[14] Refer Table 5.7 for an explanation of this table

5.40 This site had no feeder lane (either formal or informal) although a virtual lane was marked on the plans. There was a part-width reservoir covering the inside of the two straight ahead only lanes.

5.41 The stop line in lane 2 had been incorrectly put in as it was level with the advanced cycle stop line, rather than the set-back motor vehicle stop line in lane 1.

5.42 There was no LAJ at Site 3.

Visibility and Weather

5.43 The weather on day one was dry and bright at times whilst on day 2 it was initially dry and overcast but began to rain at approx 17:30. Between 09:57-10:30 the sun was extremely bright and made it difficult to view the junction clearly. When darkness fell, the glare of the headlights also made it very difficult to judge reservoir encroachment precisely.

Traffic Impact on Cyclist Level of Service

5.44 This site did not have a feeder lane and it appeared to be very hard for cyclists to access the reservoir for the majority of the time during peak hours. On a few occasions, traffic waited in the reservoir due to congestion through the junction. However, this was of relatively little significance as cyclists could not often access the reservoir due to the lack of space where a feeder lane would be.

Cyclist Behaviour

5.45 The majority of cyclists, whose access to the reservoir was blocked, chose the same alternative. They turned left at the previous junction, mounted the footway, cycled along it, crossed the side road to the opposite footway and rejoined the carriageway at the next junction.

5.46 Only a small number of cyclists crossed the junction during the red phase. This was mainly carried out as one movement.

Table 5.11 – Site 3 Reservoir Encroachment

Degree of encroachment[15]	Car/van	HGV/ bus	PTW	Total
Up to 25%	48.1%	50.3%	11.6%	45.7%
25% to 50%	9.8%	7.3%	3.3%	8.9%
Over 50%	42.1%	42.3%	85.1%	45.4%
Total	**303**	**69**	**30**	**401**

5.47 Encroachment was very high at this site by all vehicle users. However, levels of encroachment remained much higher for motorcyclists.

[15] Refer paragraph 5.2 for an explanation of these categories.

Table 5.12 – Site 3 Cyclist information[16]

	Daily number of cyclists	Passed through in green phase	Arrived in Red Phase	Stopped in reservoir	Stopped beyond reservoir	Ignored red light
Average No.	134	98.5	35.5	10	12	13.5
Percentage	-	74%	26%	28%	34%	38%

5.48 Average daily cycle flows were 134, with nearly three quarters of cyclists arriving at the junction during a green signal. Of the 26% who arrived during a red phase, just 28% waited in the reservoir, 34% beyond the reservoir and 38% ignored the red signal. The remaining 39% used the adjacent footway.

SITE 4: STANTHORPE ROAD (WESTBOUND)

Figure 5.4 – Photo of Site 4

Junction Layout

5.49 This site was the eastern approach (on a one-way street) of a four-arm junction. There was a standard layout ASL with a conventional (advisory) feeder lane. The junction has yellow box hatching. This approach was the minor road at the junction with the A23.

[16] Refer Table 5.7 for an explanation of this table

5.50 The site was intended to act as a control for PWRs as it has no right turn.

Visibility and Weather

5.51 The weather during the two days of videoing was overcast but dry.

5.52 Visibility along the reservoir feeder lane extended to the length of three cars (10m to 15m). Judgement of the level of encroachment onto the reservoir was adequate even during the hours of darkness.

Traffic Impact on Cyclist Level of Service

5.53 It appeared that buses were permitted to turn right from Stanthorpe Road. At times, crossing traffic blocked the path of buses wishing to turn right from Stanthorpe Road along with vehicles and cyclists wishing to proceed straight ahead.

5.54 Vehicles were observed to turn left from Stanthorpe Road when they were unable to clear the junction fully. Such vehicles provided insufficient room for left turning cyclists, between the vehicle and the kerb and provided no clear path for cyclists wishing to proceed straight ahead. The low number of cyclists resulted in this being a problem on very few occasions.

5.55 Buses were observed to stop at a bus stop located within the length of the reservoir feeder lane. This blocked the approach to the junction for cyclists. The buses then often pulled out from this stop and moved towards the offside lane. The lack of distance from the bus stop resulted in the bus blocking both lanes for cyclists and motorists from time to time.

Cyclist Behaviour

5.56 Several cyclists were observed ignoring the red aspect and crossing the junction. This manoeuvre was often done in steps, at times using the footpath and pedestrian crossing, at others pausing at the median and/or using the pedestrian island on Gleneagle Road where necessary. Cyclists would use both sides of the pedestrian island on Gleneagle Road.

5.57 Cars turning left from the junction were sometimes stopped in the yellow box in the middle of junction due to congestion. This occasionally blocked the movement of cyclists crossing the junction.

Table 5.13 – Site 4 Reservoir Encroachment

Degree of encroachment[17]	Car/van	HGV/ bus	PTW	Total
Up to 25%	73%	41%	48%	71%
25% to 50%	13%	14%	14%	13%
Over 50%	13%	46%	39%	15%
Total	**904**	**22**	**44**	**970**

[17] Refer paragraph 5.2 for an explanation of these categories.

5.58 71% of all vehicles had a minimal level of encroachment. Cars had the lowest level of encroachment but HGV/buses had higher encroachment than PTWs.

Table 5.14 – Site 4 Feeder Lane Encroachment

Degree of encroachment	Car/van	HGV/bus	Total
No or slight encroachment	100%	43%	99%
Up to a third	0%	43%	0%
More than a third (lane effectively blocked)	0%	14%	0%
Total	**718**	**7**	**725**

5.59 The (standard layout) feeder lane had very low levels of encroachment with 99% of all vehicles either not encroaching or slightly encroaching. A small percentage (14%) of HGVs/buses effectively blocked the feeder lane by their encroachment.

Table 5.15 – Site 4 Cyclist information[18]

	Daily number of cyclists	Passed through in green phase	Arrived in Red Phase	Stopped in reservoir	Stopped beyond reservoir	Ignored red light
Average No.	24	4	20	5.5	10.5	4.5
Percentage		17%	83%	27%	51%	22%

5.60 The flow of cyclists was very low averaging 24.5 per day and most of these (83%) arrived when the signals were red. Of those, about a quarter (27%) used the ASL correctly, just over a half stopped beyond the reservoir and 22% ignored the red light.

[18] Refer Table 5.7 for an explanation of this table

SITE 5: CAMBERWELL NEW ROAD/BOLTON STREET (NORTHWEST BOUND)

Figure 5.5 – Photo of Site 5

Junction Layout

5.61 The part of this four-arm junction selected for the study was the south-eastern approach (Camberwell New Road).

5.62 The two lane approach had a standard ASL with an advisory feeder lane. The junction had yellow box hatching.

5.63 There was a ‘no right turn’ from the approach and the site was, therefore, intended to act as a control for a PWR.

Visibility and Weather

5.64 The weather during the two days of filming was overcast but dry.

5.65 The camera position was adequate although a shiny road surface made judging reservoir encroachment more difficult during the hours of darkness due to glare and reflection caused by headlights.

5.66 Judgement of the level of feeder lane encroachment was hindered when buses or HGVs were at the front of the queue. This occurred mainly in the peak period approximately every 15 minutes.

Traffic Impact on Cyclist Level of Service

5.67 There was a bus lane, which ended approximately 40m before the junction. Buses approaching the junction from the bus lane nearly always encroached upon the feeder lane and prevented cyclist access to the reservoir. The problem was magnified when there was a bus or HGV in the offside lane as this further narrowed available space.

5.68 During peak periods, traffic queues often formed across the junction. Vehicles would queue across the ASL but rarely enter the yellow hatched box. The green phase would finish and vehicles would be left fully encroaching into the reservoir, hampering cyclist access. It is of note, however, that this commonly occurred in the offside lane part of the reservoir which was very rarely used by waiting cyclists.

5.69 Motorcyclists frequently used the ASL during red phases. During the peak hour, when both motorcyclist and cyclist flow was at its highest, they sometimes took all available space within the reservoir.

Cyclist Behaviour

5.70 Many cyclists were seen ignoring the red phase. This manoeuvre was performed fluidly if traffic allowed or, more often, in stages. Occasionally, the pedestrian crossing for the junction with Foxley Road was used by cyclists, to avoid crossing the junction during a red phase.

5.71 Cyclist use of the ASL was limited. Most chose either to ignore the red signal and continue across the junction or wait further across the junction at the eastern corner to the southerly movement on Foxley Road. This occurred both when the ASL was empty and occupied by a vehicle.

Table 5.16 – Site 5 Reservoir Encroachment

Degree of encroachment[19]	Car/van	HGV/ bus	PTW	Total
Up to 25%	76%	80%	26%	66%
25% to 50%	7%	5 %	5%	6%
Over 50%	18%	15%	71%	29%
Total	**604**	**129**	**199**	**932**

5.72 Two thirds of all vehicles either encroached slightly or not at all. Along with most sites, cars encroached the least and PTWs the most. Nearly 80% of PTWs advanced beyond the halfway point in the ASL reservoir.

[19] Refer paragraph 5.2 for an explanation of these categories.

Table 5.17 – Site 5 Feeder Lane Encroachment

Degree of encroachment	Car/van	HGV/bus	Total
No or slight encroachment	91.8%	7.6%	63.4%
Up to a third	7%	15%	9.5%
More than a third (lane effectively blocked)	1.2%	78%	27.1%
Total	**257**	**131**	**388**

5.73 Feeder lane compliance was high for cars and vans (93% encroached very little or not at all). However, nearly two thirds of all buses and HGVs blocked the cycle lane to the extent that cyclists could no longer use it.

Table 5.18 – Site 5 Cyclist information[20]

	Daily number of cyclists	Passed through in green phase	Arrived in Red Phase	Stopped in reservoir	Stopped beyond reservoir	Ignored red light
Average No.	416	234	182	40	34	108
Percentage		56%	44%	22%	19%	59%

5.74 There was a relatively high daily cycle flow at this site with an average of 416. Most arrived at a green phase, with 44% when the signals were red. Of the 44%, 22% used the ASL correctly, 19% stopped beyond the reservoir and over half carried on through the junction.

[20] Refer Table 5.7 for an explanation of this table

SITE 6: PECKHAM ROAD/WILSON ROAD (WESTBOUND)

Figure 5.6 – Photos of Site 6

Junction Layout

5.75 The part of this four arm junction selected for study was the two-lane, eastern approach on Peckham Road.

5.76 There was a part-width reservoir crossing the nearside lane and a virtual cycle feeder lane. The junction had yellow box hatching.

Visibility and Weather

5.77 The weather during the two days of videoing was clear and dry.

5.78 Judgement of the level of feeder lane encroachment was hindered when buses or HGVs were at the front of the queue due to impaired visibility.

5.79 Judgement of the level of encroachment on the reservoir was made difficult during the hours of darkness, due to the glare of the vehicle headlights.

Traffic Impact on Cyclist Level of Service

5.80 There was a bus stop on the approach to the junction. Buses approaching the bus stop nearly always encroached on the feeder lane preventing cyclist access to the reservoir. The problem was magnified when there was also either a bus or HGV in the offside lane as this further narrowed the space available. This occurred between ten and twenty times per hour. Cyclists behind the buses at the bus stop would have to overtake the bus by using lane 2. This action caused some minor conflicts between cyclists and passing vehicles in lane 2.

5.81 During peak periods, traffic queues often formed across the junction. Vehicles would often queue across the ASL and, on occasions, enter the yellow hatched box. The green phase would finish and vehicles would be left fully encroaching into the reservoir, hampering cyclist access.

5.82 Many cyclists would pass through the green phase. A common trend was to get stuck behind a bus in lane 1, as the bus encroached into the LAJ, as it crossed the junction.

Cyclist Behaviour

5.83 Many cyclists were observed to ignore the red phase and cross the junction. This manoeuvre was performed fluidly if traffic allowed or, more often, in stages. Occasionally the pedestrian crossing for the junction with Wilson Road was used by cyclists, to avoid crossing the junction during a red phase.

5.84 When reservoir access was completely blocked by buses and queues crossing the junction, some cyclists would collect in the outside of lane 2. As the traffic moved off, the cyclists would then ride across the yellow box junction to gain access to the LAJ. This action again caused some conflicts between cyclists and vehicles.

Table 5.19 – Site 6 Reservoir Encroachment

Degree of encroachment[21]	Car/van	HGV/ bus	PTW	Total
Up to 25%	80%	84%	52%	78%
25% to 50%	11%	9%	15%	11%
Over 50%	9%	8%	33%	11%
Total	**853**	**257**	**86**	**1196**

5.85 78% of vehicles either did not encroach at all or encroached very little. Compliance was slightly better for buses/HGVs than for cars but PTWs were the worst offenders.

Table 5.20 – Site 6 Feeder Lane Encroachment

Degree of encroachment	Car/van	HGV/bus	Total
No or slight encroachment	70%	4%	39%
Up to a third	17%	6%	12%
More than a third (lane effectively blocked)	14%	90%	50%
Total	**222**	**197**	**419**

5.86 Feeder lane encroachment was considerable with only 39% of all vehicles keeping out of all or most of the feeder lane. 90% of all buses/HGVs effectively blocked access to the feeder lane.

Table 5.21 – Site 6 Cyclist information[22]

	Daily number of cyclists	Passed through in green phase	Arrived in Red Phase	Stopped in reservoir	Stopped beyond reservoir	Ignored red light
Average No.	258.5	184.5	74	4.5	24.5	45
Percentage		71%	29%	6%	33%	60%

5.87 Cycle flows were high with the large majority arriving at a green phase. Of the 29% who arrived during a red phase, just 6% used the reservoir correctly, 33% stopped beyond it and 60% ignored the red signal.

[21] Refer paragraph 5.2 for an explanation of these categories.
[22] Refer Table 5.7 for an explanation of this table

SITE 7: CAMBERWELL CHURCH STREET/ARTICHOKE PLACE (EASTBOUND)

Figure 5.7 – Photo of Site 7

Junction Layout

5.88 This junction had an eastbound single lane approach (which operated as two in busy periods) at a four arm junction. The site has a standard ASL reservoir with a VCL.

Visibility and Weather

5.89 The weather on both survey days was dry and bright.

5.90 The camera location was relatively far back but tape 'guidelines' were put on the screen to improve the accuracy of encroachment data.

5.91 Judgement of the level of encroachment on the reservoir was inadequate during the some of the time due to the glare of headlights. The first 15 minutes were unwatchable for the level of encroachment and, during this short spell, only cyclists were recorded passing in the LAJ.

Traffic Impact on Cyclist Level of Service

5.92 As noted above, this approach sometimes operates as two lanes. On most of these occasions, degree of encroachment into the feeder lane was recorded. On some of these occasions the feeder lane was blocked completely.

5.93 At two particular locations (one just before the feeder lane starts, and the second just after the second turning to the left after the junction), vehicles stopped frequently with hazard lights on. These areas are parking bays but tend to impede the flow of cyclists.

Cyclist Behaviour

5.94 A small majority of cyclists ignored the red signal. Some crossed in stages, as traffic conditions allowed.

Table 5.22 – Site 7 Reservoir Encroachment

Degree of encroachment[23]	Car/van	HGV/bus	PTW	Total
Up to 25%	84%	67%	8%	69%
25% to 50%	14%	13%	9%	14%
Over 50%	12%	20%	83%	17%
Total	**432**	**69**	**59**	**559**

5.95 This site followed a similar pattern to others where car drivers encroach the least and the majority of PTWs encroached by over 50%.

Table 5.23 – Site 7 Feeder Lane Encroachment

Degree of encroachment	Car/van	HGV/bus	Total
No or slight encroachment	85%	97%	87%
Up to a third	11%	2%	10%
More than a third (lane effectively blocked)	3%	1%	3%
Total	**372**	**73**	**445**

5.96 Feeder lane encroachment was quite low at this site. Unusually, cars encroached more than wide vehicles. However, the reason for this is likely to be that, during the peak period, the lane operates as two and cars are no longer able to keep out of the feeder lane as they approach the reservoir.

Table 5.24 – Site 7 Cyclist information[24]

	Daily number of cyclists	Passed through in green phase	Arrived in Red Phase	Stopped in reservoir	Stopped beyond reservoir	Ignored red light
Average No.	254	195	59	14	6	39
Percentage		77%	23%	24%	10%	66%

[23] Refer paragraph 5.2 for an explanation of these categories.
[24] Refer Table 5.7 for an explanation of this table

5.97 Cycle flows were fairly high at this site. Most arrived in a green phase and, of those arriving in a red, 23% used the ASL correctly, and 66% ignored the red signal.

SITE 8: VAUXHALL BRIDGE ROAD/MILLBANK (NORTHEAST BOUND)

Figure 5.8 – Photo of Site 8

Junction Layout

5.98 The approach selected at this four arm junction (of Vauxhall Bridge Road, Millbank, Bessborough Garden and Grosvenor Road) was the north-east bound approach.

5.99 The site has a standard layout ASL reservoir and feeder lane. Vauxhall Bridge Road has four lanes. Lane 1 permits left turn and straight through traffic, lane 2 permits straight ahead, lane 3 permits straight ahead and right turns, and lane 4 permits right turn only. The three through lanes merge into two lanes just after the junction but three rows of traffic sometimes pass through the exit arm pinch point.

Visibility and Weather

5.100 Videoing for this site was undertaken on 24th and 25th November 2004.

5.101 The weather during the two days of videoing was overcast with no precipitation visible from the video.

5.102 Feeder lane visibility was obscured when HGVs were occupying lane 1.

5.103 The reflective road surface made it difficult to judge reservoir encroachment during the hours of darkness due to glare and reflection cause by headlights.

Traffic Impact on Cyclist Level of Service

5.104 Traffic flows were very high at this site.

5.105 Motorcyclists tended to use the feeder lane to access the ASL reservoir most of the time, especially during peak hours, when queues were long. There were up to twelve motorcyclists at any green phase. Motorcyclists often blocked access to the reservoir for cyclists.

5.106 When motor vehicles turned left on to Bessborough Garden, they cut across the LAJ, causing some minor conflicts with cyclists travelling straight ahead.

5.107 Some PTW users occupied the LAJ even when cyclists were using it. This appeared to cause some minor conflicts as the PTWs sometimes followed very close behind the cyclists probably resulting in some intimidation or discomfort.

5.108 As traffic passed during the green phase, there was some encroachment in the LAJ, mainly from HGVs. This normally occurred when cyclists were not present. However, on a few occasions the cyclist was forced to ride between the kerb and the LAJ.

5.109 Sometimes when the junction became congested, drivers passed the stop line when the lights are green, but did not clear the junction before the lights went red. This resulted in some encroachment onto the ASL.

Cyclist Behaviour

5.110 Many cyclists were observed to ignore the red aspect and cross the junction. The straight-through manoeuvre was often done in steps, sometimes using the footpath and pedestrian crossing, and other times pausing at the median and/or using the pedestrian island on Bessborough Garden.

5.111 Cyclists tended to stop closest to the feeder lane or simply in the lane itself, which would prevent access to cyclists arriving behind them.

5.112 When there were lots of cyclists, they tended to cluster in the reservoir in front of lane 1 or just beyond it. Most stayed in the LAJ when crossing the junction, whilst a few cyclists left the LAJ to pass other cyclists.

Table 5.25 – Site 8 Reservoir Encroachment

Degree of encroachment[25]	Car/van	HGV/ bus	PTW	Total
Up to 25%	88%	93%	12%	67%
25% to 50%	6%	3%	14%	9%
Over 50%	6%	4%	65%	24%
Total	**1353**	**70**	**648**	**2071**

5.113 Car and HGV encroachment was relatively low. However, most PTWs encroached by over 50%. The sheer number of motorcyclists at this site meant that the total level of encroachment was high with just two thirds of all vehicles either slightly encroaching or not encroaching at all.

Table 5.26 – Site 8 Feeder Lane Encroachment

Degree of encroachment	Car/van	HGV/bus	Total
No or slight encroachment	99%	85%	98%
Up to a third	0%	10%	1%
More than a third (lane effectively blocked)	1%	6%	1%
Total	**765**	**33**	**798**

5.114 Levels of feeder lane encroachment were very low at this site for cars/vans and relatively low for wider vehicles.

Table 5.27 – Site 8 Cyclist information[26]

	Daily number of cyclists	Passed through in green phase	Arrived in Red Phase	Stopped in reservoir	Stopped beyond reservoir	Ignored red light
Average No.	410.5	99.5	311	103	187	21
Percentage		24%	76%	33%	60%	7%

5.115 This site had very high cycle flows. Very few cyclists ignored the red signal at this site although the majority stopped in advance of the ASL reservoir.

[25] Refer paragraph 5.2 for an explanation of these categories.
[26] Refer Table 5.7 for an explanation of this table

SITE 9: VAUXHALL BRIDGE ROAD/MILLBANK (NORTHWEST-BOUND)

Figure 5.9 – Photo of Site 9

Junction Layout

5.116 The approach selected at this four arm junction (of Vauxhall Bridge Road, Millbank, Bessborough Garden and Grosvenor Road) was the north-west bound approach.

5.117 The site has a standard layout ASL reservoir and feeder lane. Vauxhall Bridge Road has four lanes. Lane 1 permits left turn and straight through traffic, lane 2 permits straight ahead, lane 3 permits straight ahead, and lane 4 permits right turn only. There are usually two or three lanes of traffic at the exit arm pinch point.

Visibility and Weather

5.118 The weather during the two days of videoing was overcast with no precipitation visible from the video.

Traffic Impact on Cyclist Level of Service

5.119 Traffic flows were very high at this site. There were, however, many fewer motorcyclists compared with the northeast bound approach.

Cyclist Behaviour

5.120 As cyclists entered the exit arm pinch point, many would look over their right shoulder to check that it was safe to enter into Bessborough Gardens suggesting a level of uncertainty or anxiety. Many cyclists were seen to ignore the red aspect and drift across to the edge of the pedestrian island. They would then wait for the opportunity to cross into Bessborough Gardens.

5.121 The feeder lane into the (standard layout) reservoir seemed to work well.

Table 5.28 – Site 9 Reservoir Encroachment

Degree of encroachment[27]	Car/van	HGV/ bus	PTW	Total
Up to 25%	81%	75%	42%	78%
25% to 50%	16%	14%	0%	16%
Over 50%	3%	11%	59%	7%
Total	**1154**	**162**	**65**	**1381**

5.122 Encroachment was relatively low with nearly 80% of all vehicles keeping out of most of the reservoir

Table 5.29 – Site 9 Feeder Lane Encroachment

Degree of encroachment	Car/van	HGV/bus	Total
No or slight encroachment	93%	79%	92%
Up to a third	5%	21%	7%
More than a third (lane effectively blocked)	1%	0%	1%
Total	**309**	**39**	**348**

5.123 Feeder lane encroachment was relatively low at this site.

Table 5.30 – Site 9 Cyclist information[28]

	Daily number of cyclists	Passed through in green phase	Arrived in Red Phase	Stopped in reservoir	Stopped beyond reservoir	Ignored red light
Average No.	251	126	125	45	42	38
Percentage		50%	49%	36%	34%	30%

[27] Refer paragraph 5.2 for an explanation of these categories.
[28] Refer Table 5.7 for an explanation of this table

SITE 10: VAUXHALL BRIDGE ROAD/ROCHESTER ROW (NORTHWEST BOUND)

Figure 5.10 – Photo of Site 10

Junction Layout

5.124 The northwest bound approach was selected at this four arm junction of Vauxhall Bridge Road, Rochester Way and Warwick Way.

5.125 This site had a part-width reservoir, a virtual cycle lane and a cycle lane across the junction.

5.126 The northwest approach, nearside lane, permits left turns and straight ahead movements whilst the offside lane permits straight ahead only. There is no right turn from either direction.

5.127 The virtual cycle lane extends back to the bus cage.

Visibility and Weather

5.128 During both days of filming, the weather was either fine or overcast with no precipitation.

5.129 The camera position was adequate although visibility was reduced during hours of darkness due to glare and reflection caused by vehicle headlights.

5.130 Judgement of the level of feeder lane encroachment was hindered when buses or HGVs were at the front of the queue. This occurred mostly at peak hours at a level of approximately ten times every hour.

Traffic Impact on Cyclist Level of Service

5.131 Buses and HGVs approaching the junction often encroached into the feeder lane due to the narrow width of the nearside lane. This problem was compounded if there was a wide vehicle in the offside lane at the same time as this further reduced the width available.

5.132 Motorcyclists frequently used the ASL reservoir during red phases. This occurred throughout the entire period of analysis i.e. it was not confined to peak hours. The number of motorcyclists was greater during the peak hours and therefore this reflects in the number recorded. However, proportionally, the rate of incidence was no higher during these hours. Occasionally this would lead to less space available for cyclists but the reservoir was not deemed to be over-capacity.

5.133 Encroachment into or beyond the stop line by motor vehicles appeared low especially in the nearside lane. It appeared that the order in which vehicles arrived had an influence over the likelihood of them encroaching. If vehicles arrived in the offside lane first, and stopped at the stop line with no reservoir in front of them, vehicles that then arrived in the nearside lane seemed to adhere to the stop line as well – thus not encroaching into the PWR.

Cyclist Behaviour

5.134 Many cyclists were observed to ignore the red signal and cross the junction. This manoeuvre was performed fluidly, if traffic conditions allowed or, more often, in stages. Frequently, they would wait on the easterly corner of Warwick Way or on occasion mount the footpath in front of George Elliot House. This caused both actual and potential conflict with pedestrians. This pattern of use did not correspond to occupancy of the ASL by another vehicle.

Table 5.31 – Site 10 Reservoir Encroachment

Degree of encroachment[29]	Car/van	HGV/ bus	PTW	Total
Up to 25%	82%	71%	12%	72%
25% to 50%	8%	7%	7%	8%
Over 50%	11%	22%	81%	20%
Total	**638**	**130**	**94**	**877**

5.135 Encroachment was relatively low at this site with 72% of all vehicles encroaching slightly or not at all. As at other sites, PTW encroachment was very high.

[29] Refer paragraph 5.2 for an explanation of these categories.

Table 5.32 – Site 10 Feeder Lane Encroachment

Degree of encroachment	Car/van	HGV/bus	Total
No or slight encroachment	77%	7%	57%
Up to a third	16%	17%	16%
More than a third (lane effectively blocked)	7%	76%	26%
Total	**632**	**248**	**880**

5.136 Feeder lane encroachment was quite high. Three quarters of cars/vans caused minimal encroachment but the large majority of wide vehicles effectively blocked the feeder lane.

Table 5.33 – Site 10 Cyclist information[30]

	Daily number of cyclists	Passed through in green phase	Arrived in Red Phase	Stopped in reservoir	Stopped beyond reservoir	Ignored red light
Average No.	197.5	100	98	20	46	32
Percentage		50.6%	49.6%	20%	47%	33%

5.137 Cycle flows were quite high with most arriving at the junction on a green signal. However, of those arriving in a red phase, a third continued through the junction, nearly 50% stopped beyond the reservoir and just 20% used the ASL correctly.

[30] Refer Table 5.7 for an explanation of this table

6. Cyclist Conflict Results

6.1 Cyclist conflict was assessed at each site using the video footage. The conflict assessment technique was loosely based on that used in the TRL conflict study with a few alterations. The TRL study "*Behaviour at Cycle Advance Stop Lines*" (carried out in 2002) used five categories; precautionary braking/lane change, controlled braking/lane change, rapid deceleration/lane change resulting in a near miss, emergency braking/violent swerve resulting in a near miss, emergency action followed by collision. It was thought that some of these categories were too similar, particularly given the difficulty in determining the degree of conflict by video analysis and would consequently have implications for the consistent recording of conflict. Three categories were, therefore, used to cover the five TRL ones. These are:

- minor conflict (cyclist/motorist has to brake or change direction but movement is calm and controlled);
- major conflict (cyclist/motorist has to take emergency action in what is considered to be a near miss); and
- a collision.

6.2 An additional category was used which was defined as:

- cyclist discomfort (where the cyclist did not brake or change direction but was likely to have felt discomfort perhaps due to the close proximity of another vehicle).

OVERVIEW OF CONFLICT

6.3 No conflict was recorded at Site 1. This may be in part due to the low daily cycle flows (average of 29.5).

6.4 Site 2 was another low flow site with an average of just 29.5 cyclists recorded between 7am and 7pm. One minor conflict was recorded at this site.

6.5 Site 3 had a medium cycle flow of 134 per day. No conflict was recorded at this site. This site had no feeder lane leading into the reservoir and many cyclists were observed using the footway to bypass the queuing traffic.

6.6 Site 4 had a low cycle flow with an average of just 24 per day. One 'discomfort' conflict incident and four 'minor' conflict incidents occurred although none of these involved cyclists on the key approach.

6.7 Site 5 had a relatively high cycle flow with an average daily flow of 416. Three conflict incidents were recorded at this site; one major, one minor, and one 'discomfort' conflict.

6.8 Site 6 had a relatively high daily cycle flow (258.5). Nine conflict incidents were recorded; five discomfort, three minor conflicts and one major conflict.

6.9 No conflicts were recorded at Site 7. The average daily cycle flow was relatively high (254) and the majority arrived during a green phase.

6.10 At Site 8, nine conflict incidents were recorded; four minor and five discomfort. Cycle flows were very high at this site averaging 410 per day.

6.11 At Site 9 there was a high average daily cycle flow of 251. Three conflict incidents were recorded, all of which were discomfort.

6.12 At Site 10, the average daily cycle flow was 197.5. Seven conflict incidents were recorded; one major and six discomfort.

6.13 Table 6.1 summarises the details of each of the observed conflicts. The locations of the conflicts are shown within Appendix B.

Table 6.1 – Summary of Conflicts Observed

ID	Time	Conflict Level	Description	Contributory factor
Site 2 (A23) Purley Way / Commerce Way				
1.	12:14	Minor	The cyclist approached the junction in lane 2 to overtake queuing traffic in lane 1. On approaching the junction, the cyclist's route through was blocked and he moved outside lane 3 to access the reservoir. He reached the reservoir just as the green phase began and attempted to cut into the inside lane in order to turn left.	Cyclist offside
Site 4 (A23) Streatham High Road / Stanthorpe Road				
2.	07:55	Dis-comfort	Cyclist exited from the reservoir to go straight ahead. When green phase began, cyclist went straight ahead and a car approached from behind her (to the right) to turn left. Car was very close to cyclist and likely to have made her feel uncomfortable. The car was encroaching slightly onto the (standard layout) ASL reservoir. If the car had kept out, it is possible that this 'conflict' would not have taken place.	Motorist behaviour
3.	12:08	Minor Conflict	Cyclist travelled southbound on the A23 and ignored the red signal. Traffic emerged from Stanthorpe Road on a green signal and had to brake to avoid cyclist. The layout of the ASL was unlikely to have contributed to the conflict. However, vehicles emerging from Stanthorpe Road were encroaching onto the ASL reservoir and the event might have been less of a 'near miss' if they had waited behind the stop line. The main cause of the conflict, however, appeared to be the cyclist ignoring the red signal.	Cyclist crossed oncoming traffic (ignoring red signal)

ID	Time	Conflict Level	Description	Contributory factor
4.	14:45	Minor Conflict	Cyclist travelling northbound on footway crossed Stanthorpe Road as signals turned to green and traffic emerged. Car had to slow down as cyclist crossed its path. The car involved had been encroaching into the reservoir, occupying approximately 50% of the available space. Had the car waited at the first stop line, the conflict would have been less likely to occur.	Cyclist crossed oncoming traffic (ignoring red signal)
5.	14:53	Minor Conflict	Cyclist travelling southbound on A23 appeared to have ignored red signal. Traffic emerging from Stanthorpe Road had to slow down to avoid hitting her. ASL layout appears to have had no bearing on the conflict. However, vehicles waiting at the stop line were encroaching slightly into the reservoir.	Cyclist crossed oncoming traffic (ignoring red signal)
6.	16:48	Minor Conflict	Cyclist travelling northbound cut between queuing traffic emerging from Stanthorpe Road. A lorry was forced to stop but was travelling very slowly so little risk to either vehicle. This took place on the other side of the junction from the ASL so is unlikely to have been influenced by its design.	Lorry did not see cyclist weaving between stationary vehicles
Site 5 (A202) Camberwell New Road / Bolton Crescent				
7.	07:06	Dis-comfort	Cyclist travelling across the junction attempted to undertake a stationary bus through a very narrow gap. Bus moved off whilst cyclist undertook. This took place whilst traffic was 'stranded' across the junction (the signals had changed to red before the motor vehicles had passed through the junction). ASL layout unlikely to have directly contributed to the conflict.	Cyclist undertook (narrow gap)
8.	08:39	Major Conflict	Cyclist was riding on the footway to bypass the queuing traffic on Camberwell New Road. Cyclist re-entered the junction via Foxley Road on a red signal and had a very near miss with a cyclist on Camberwell New Road. This conflict appeared to be related more to cyclist behaviour than to the ASL layout.	Cyclist, ignoring red traffic signal) crossed oncoming traffic
9.	13:37	Minor Conflict	Car turning right into Foxley Road cut into path of oncoming cyclist causing cyclist to swerve.	Motorist behaviour Car Right Turn

ID	Time	Conflict Level	Description	Contributory factor
Site 6 (A202) Peckham Road / Wilson Road				
10.	08:20	Major Conflict	Cyclist reached junction by cycling in the oncoming traffic lane (the with-flow two lanes are congested), as the cycle feeder lane was blocked by buses. As the cyclist reached the junction, he cut in past the traffic just as the signals went to green. The car in lane 2 is forced to brake suddenly to avoid hitting the cyclist. The car was correctly positioned, behind the ASL stop line.	Cyclist behaviour and Cyclist offside
11.	09:22	Dis-comfort	Cyclist unable to reach the junction via the feeder lane due to bus encroachment so approached in lane 2. Appeared to be uncomfortable attempting to get back into the nearside lane in the main part of the junction, which he eventually managed to do.	Cyclist offside
12.	09:48	Dis-comfort	Cyclist unable to reach the junction via the feeder lane due to bus encroachment. Cyclist therefore approaches in lane 2. On passing through the junction, the cyclist was undertaken by a bendy bus which is likely to have been an uncomfortable situation for the cyclist.	Cyclist offside
13.	10:14	Dis-comfort	Cyclist unable to reach the junction via the feeder lane due to buses encroached in it. Cyclist approached in lane 2. On passing through the junction, the cyclist was undertaken by a bendy bus.	Cyclist offside
14.	11:58	Minor Conflict	Cyclist on Peckham Road ignored red signal and has to swerve to avoid a car pulling out of Wilson Road (which braked to avoid cyclist).	Cyclist ignoring red signal, crossed oncoming traffic
15.	12:09	Dis-comfort	Cyclist was unable to reach the junction via the feeder lane due to bus encroachment. Cyclist approached junction by overtaking traffic in lane 2 as green phase began, and was unable to get back to the nearside lane as he crossed the junction.	Cyclist offside
16.	13:13	Minor Conflict	Cyclist ignored red signal. Pedestrians stepped out into the road and cyclist swerved onto footway to avoid them.	Cyclist ignoring red signal crossed oncoming traffic

ID	Time	Conflict Level	Description	Contributory factor
17.	13:24	Dis-comfort	Cyclist was unable to reach the junction via the feeder lane due to bus encroachment. Cyclist therefore approached in lane 2. Appeared to be uncomfortable attempting to get back into the nearside lane which he eventually achieves.	Cyclist offside
18.	17:02	Minor Conflict	Cyclist was unable to reach reservoir by feeder lane so passed stationary bus, reached junction, as the green phase began. Cyclist wobbled in front of bus as he manoeuvred back to the nearside.	Cyclist offside
Site 8 (A202) Vauxhall Bridge Road / Millbank (Northeast bound)				
19.	08:35	Dis-comfort	Cyclist in LAJ was overtaken by several PTW riders. One overtook close to the cyclist (within 50cms) which caused the cyclist to swerve slightly.	PTW behaviour
20.	08:55	Dis-comfort	PTW passed very close to cyclist at end of LAJ by the exit arm pinch point. Cyclist likely to have felt some discomfort.	PTW behaviour
21.	09:01	Dis-comfort	PTW approached cyclist from behind in LAJ. Then left LAJ to squeeze between cyclist and car. Discomfort likely to have been felt but all vehicles moving at similar speed (approximately 10mph).	PTW behaviour
22.	10:17	Minor conflict	White van cut across cyclist (going straight ahead in LAJ) to turn left into Bessborough Gardens. Cyclist had to brake then signal to continue in LAJ in front of a left-turning lorry.	Motorist behaviour-Van left turn
23.	13:05	Minor conflict	Cyclist continuing straight ahead in the LAJ had to slow down as a car turned to the left immediately in front of him (into Bessborough Gardens). Cyclist appeared to anticipate motorist behaviours as he 'freewheels' until the car turned across him.	Motorist behaviour Car Left Turn
24.	13:14	Dis-comfort	White van turned left immediately before cyclist. Appeared to give the cyclist very little clearance. Cyclist was positioned inside the LAJ (i.e. to its left) at the time of the conflict.	Motorist behaviour Van Left Turn
25.	09:39	Dis-comfort	HGV caught up a cyclist travelling through the junction in the LAJ. As lorry approached the exit arm, it braked to allow the cyclist through the pinch point. Cyclist likely to have felt some discomfort due to close proximity of the lorry.	HGV behaviour

ID	Time	Conflict Level	Description	Contributory factor
26.	10:45	Minor conflict	Cyclist reached reservoir via feeder lane as green phase began. He found himself caught between vehicles moving off and needed to signal assertively to get past traffic and make the right turn. This situation was possibly made worse by the presence of PTWs in the ASL reservoir.	Cyclist nearside for right turn Layout
27.	13:58	Dis-comfort	Three motor vehicles (including two vans) approached the exit arm pinch point simultaneously. There was a cyclist in the LAJ. The van on the inside lane slowed down to allow the cyclist through the pinch point on the LAJ.	Motorist behaviour Layout
Site 9 (A202) Vauxhall Bridge Road / Millbank (Northwest bound)				
28.	08:00	Dis-comfort	Cyclist pulled in from junction into pinch point at exit arm, van passed quite close (approx 50cms).	Motorist behaviour
29.	08:28	Dis-comfort	Cyclist followed by car close behind over junction and into exit arm.	Motorist behaviour
30.	08:40	Dis-comfort	Cyclist at pinch point squeezed into a 1.0m gap as car over-took	Motorist behaviour
Site 10 (A202) Vauxhall Bridge Road / Warwick Way				
31.	09:13	Dis-comfort	Feeder lane blocked by bus. Cyclist approached reservoir in lane 2 then had to cut in front of bus when green phase began.	Cyclist offside
32.	08:36	Dis-comfort	Lorry overtook cyclist with very little clearance	HGV behaviour
33.	08:50	Dis-comfort	Bus blocked feeder lane. Bike in lane 2 at the reservoir. Signals changed to green and cyclist had to pull in between bus and van to reach LAJ.	Cyclist offside
34.	08:54	Dis-comfort	Car in lane one encroached into LAJ next to cyclist who had to keep to left of LAJ as a result	Motorist behaviour
35.	09:21	Dis-comfort	Cyclist crossed junction in a red phase, junction congested, and has to weave round a taxi.	Cyclist, ignoring red signal, crossed oncoming traffic
36.	12:31	Major Conflict	Cyclist in LAJ drifted towards the edge of the lane. Car came past on her offside on the outside edge of the LAJ. Car's wing-mirror within 10cms (possibly 5cms) of the cyclist.	Cyclist and motorist behaviour
37.	18:02	Dis-comfort	Feeder lane blocked by bus. Cyclist approached outside of lane 2. Green phase began as cyclist reached the reservoir and had to weave between traffic to access the inside lane.	Cyclist offside

6.14 Table 6.1 has classified where motorists have travelled too close to a cyclist as 'motorist behaviour'. While the location of a pinch point may have contributed to a number of these types of conflict, it is felt that the motorists' choice not to wait until sufficient room is available to pass is the key contributory factor.

6.15 There was a total of 37 conflict incidents. The most common cause appeared to be cyclists approaching the ASL in an offside lane accounting for 30% of all conflict. 24% of the conflict incidents appeared to be caused by car and van driver behaviour, and 19% were due to cyclists ignoring a red signal as they crossed in front of oncoming traffic. Three conflict incidents (8% of the total) appeared to be caused by powered two wheeler driver behaviour, two by HGVs and one by cyclists undertaking on the nearside. 11% were due to 'other' reasons which were not easy to categorise.

6.16 Table 6.2 summarises the conflict per site and places these figures in context of the average daily cycle flow for each site. The 'conflict per cyclist' figures should be used with caution. This is because they are likely to contain a large error component due to the random and rare nature of accidents (for example a conflict that occurs once every three years has a 33% chance of being included in any years' data and it might have just randomly occurred on the day that the analysis happened). To some degree an error will also be introduced due to the subjective nature of classifying conflict levels such as 'minor' and 'cyclist discomfort' which will inevitably have some variability in how analysts define the various levels of conflict.

Table 6.2 – Summary of Conflict Per Site

Site	Discomfort	Minor conflict	Major conflict	Collision	Total conflict	Two day cycle flows	Conflict per cyclist
1	0	0	0	0	**0**	60	0.0%
2	0	1	0	0	**1**	60	1.7%
3	0	0	0	0	**0**	264	0.0%
4	1	0	0	0	**1**	48	2.1%
5	1	1	1	0	**3**	832	0.4%
6	5	3	1	0	**9**	518	1.7%
7	0	0	0	0	**0**	508	0.0%
8	5	4	0	0	**9**	822	1.1%
9	3	0	0	0	**3**	502	0.6%
10	7	0	1	0	**8**	388	2.1%
Total/Average					**34**	**4002**	**0.8%**

7. Discussion

7.1 This section addresses each of the assumptions outlined in Table 3.1 in the order in which they appear. The complete statistical analysis supporting this discussion can be found in Appendix C.

PART WIDTH RESERVOIRS

7.2 Table 7.1 shows the proportion of vehicles that only encroached into the reservoir by up to 25% of the reservoir length. A high proportion of vehicles encroaching to this degree indicates that the reservoir was more frequently available for cyclists to use. The higher the percentage, the greater the level of service for cyclists.

7.3 Data for the peak hour refers to the single hour over the two days when the highest number of cyclists was recorded (refer to Table 5.1 for the cycle flows and peak hours).

7.4 The off-peak period was calculated on all sites using 10:00 to 15:00 as this period excludes school and commuter traffic.

Table 7.1 – Summary of Vehicles Encroaching ≤ 25% into the Reservoir

Site	Reservoir type	All vehicles	Without PTW	All vehicles: peak hour	Without PTW: peak hour	All vehicles: off peak	Without PTW: off peak
4	Standard	71%	72.5%	71.6%	74.8%	76%	76.2%
5	Standard	66%	75.8%	56.4%	75%	79.9%	86%
7	Standard	69%	72.8%	63.5%	65.9%	70.4%	74.2%
8	Standard	67%	88.1%	47.5%	88.4%	78.9%	89.6%
9	Standard	78%	80.2%	89.9%	93.9%	85.7%	88.6%
1	PWR	68%	69.1%	82.2%	83.6%	85.3%	76.8%
2	PWR	91%	94%	92%	97.18%	92.2%	93.7%
6	PWR	78%	80.5%	82.3%	92.2%	81.5%	82.4%
10	PWR	72%	79.8%	62.4%	75.7%	77.2%	81.8%
3	Non-standard PWR	46%	50%	32.%	36.4%	51%	52.2%
Average Standard		**70%**	**78%**	**66%**	**80%**	**78%**	**83%**
Average PWR		**77%**	**81%**	**80%**	**87%**	**84%**	**84%**

7.5 The general and peak hour levels of encroachment into the reservoir show similar results. In both categories, three of the top four sites (i.e. those with the lowest encroachment) have part-width reservoirs. When PTWs are removed, Site 8 appears to perform particularly well. However, PTW flows were so high at this site that other motor vehicles would have been unable to encroach because of the presence of PTWs in the ASL reservoir.

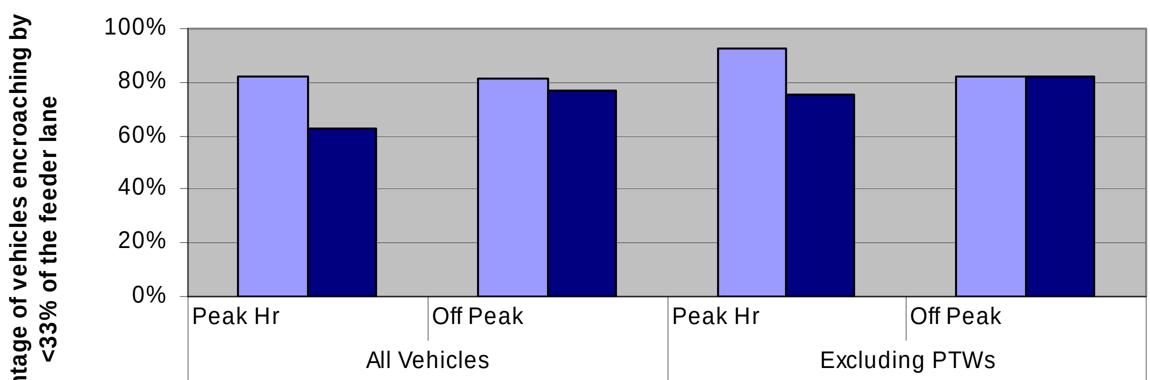
7.6 As previously mentioned, Site 3 had an incorrectly implemented PWR. The stop line in lane 2 is level with the advanced cycle stop line in lane 1 rather than the motor vehicle stop line. This is likely to encourage motor vehicles in lane 1 to draw level with those in lane 2.

Assumption A: Higher cycle flows may reduce vehicle encroachment into PWRs

7.7 Sites 6 and 10 were selected for testing this assumption. These two sites were chosen because they both had high cycle flows during peak periods. The peak hour cycles flows for Sites 6 and 10 were 50 and 53 cycles respectively, while the off peak cycle flows were an average of 13 and 10 cycles per hour respectively.

7.8 Higher percentages (in Figure 7.1) represent less motor vehicle encroachment and, therefore, a better level of service for cyclists.

Figure 7.1 – Reservoir Encroachment during Peak and Off Peak Periods



	All Vehicles		Excluding PTWs	
	Peak Hr	Off Peak	Peak Hr	Off Peak
Site 6	82%	82%	92%	82%
Site 10	62%	77%	76%	82%

7.9 These two sites had similar levels of encroachment. Figure 7.1 indicates that, when all vehicles are considered, there was no change between the peak hour and off peak period to the proportion of vehicles that encroached on the reservoir at Site 6. Site 10 results indicate that, when considering all vehicles, the reservoir was more frequently occupied during the peak period than off peak period. This is contradictory to the assumption.

7.10 When PTWs are removed from the data, the two sites result in different trends with Site 6 providing a better level of service during the peak hour, while the opposite was the case at Site 10.

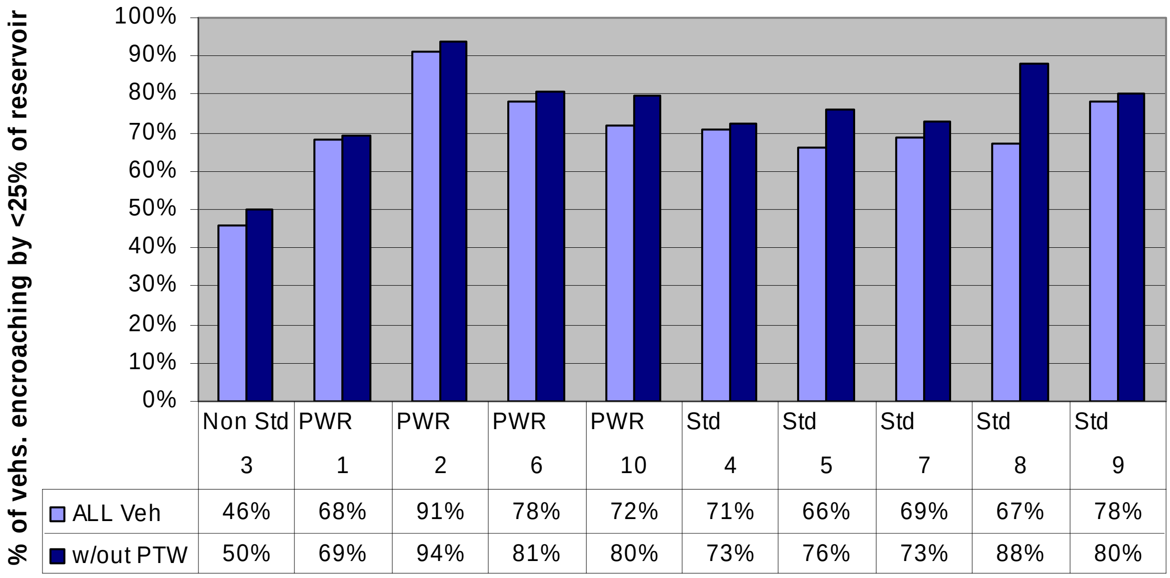
7.11 It may be that the influence of high volumes of cyclists during peak periods was off-set by a greater level of frustration and impatience from motorists due to congestion during the peak traffic hour.

7.12 Based upon the data provided, there is no evidence to support Assumption A, that higher cycle flows may reduce vehicle encroachment into PWRs. When PTWs are excluded, it appears that there is less vehicle encroachment during peak hours but the difference is not statistically significant.

Assumption B: Part-width reservoirs result in less encroachment than standard ASLs

7.13 Figure 7.2 compares the percentage of vehicles that encroach by less than 25% of the reservoir length for the sites. It was felt that 25% is the proportion of the reservoir which would not affect the level of service for cyclists. A high percentage of vehicles in Figure 7.2 indicates a good level of service for cyclists.

Figure 7.2 – Vehicles Encroaching by ≤ 25% of Reservoir Length



	Non Std 3	PWR 1	PWR 2	PWR 6	PWR 10	Std 4	Std 5	Std 7	Std 8	Std 9
ALL Veh	46%	68%	91%	78%	72%	71%	66%	69%	67%	78%
w/out PTW	50%	69%	94%	81%	80%	73%	76%	73%	88%	80%

7.14 Two series of data are included in Figure 7.2. These two series are: all vehicles; and all vehicles excluding PTW. This was done because it was felt that the high proportion of PTWs that used the reservoirs in a similar manner to cyclists may influence the results.

7.15 It is evident from Figure 7.2 is that PTWs negatively affected the level of service for cyclists at all locations. It is also clear that Site 3 had the worst levels of encroachment, with at least half of the vehicles encroaching by more than 25% into the reservoir. This is particularly interesting because of the non-standard layout of this PWR site (refer to paragraph 5.41).

7.16 On average, less reservoir encroachment occurred at the sites with PWRs when compared with ASLs. PWRs were present at three of the top four performing sites. However, this trend is not clearly defined, with Site 1 (a PWR site) performing to a similar level as the standard layout ASLs when all vehicles are considered. When PTWs are excluded, Site 1 had more encroachment (above 25%) than any of the other sites, excluding Site 3 (the non-standard PWR site).

7.17 There is statistical evidence that PWRs have lower levels of encroachment for all vehicles than standard layout ASL reservoirs.

7.18 When PTWs are excluded, there is no significant difference between encroachment between the PWRs and ASLs. It was observed that Site 8 had an unusual encroachment profile with a very large difference between total encroachment and encroachment excluding PTWs. The number of PTWs at Site 8 was particularly high and they frequently waited in the ASL reservoir. This would prevent other vehicles from encroaching so it is likely to be distorting the true encroachment situation. The analysis was therefore carried out again excluding Site 8 (which had high numbers of PTWs).

7.19 When Site 8 is excluded, there is evidence that PWRs are better than standard layout ASL reservoirs at preventing vehicle encroachment.

7.20 The data also seems to indicate that, when PTWs are excluded, PWRs are better than ASLs at preventing vehicle encroachment. However, as discussed in 7.18, this approach can be misleading as the presence of high numbers of encroaching PTWs can prevent other vehicles from encroaching on the reservoir.

Assumption C: PWRs provide insufficient cycle capacity in the reservoir where cycle flows are high

7.21 The data analysts were asked to record all instances where cyclists were unable to use the reservoir because it was either already full (for whatever reason) or the access was blocked by cyclists or PTWs. Only Site 8 had any problems with capacity. This is summarised in Table 7.2.

7.22 As can be seen, Site 8 had problems with capacity 34 times with all except one instance taking place between 07:00 and 09:33. Furthermore, in all but two instances the reservoir access was blocked by PTWs. One of the two remaining instances was the result of cyclists blocking the access to the reservoir. The remaining instance occurred when seven to eight PTWs had made use of the reservoir.

7.23 The access was generally blocked by PTWs and cyclists stopping in the ACFL parallel to the stop line or partially over it.

Table 7.2 – Summary of Reservoir over Capacity at Site 8

Time	Reason for over capacity	Total Cyclists sitting in advance of reservoir	Total Cyclists sitting in reservoir	Cyclists waiting outside reservoir
07:07	PTW blocking feeder lane	0	0	2
07:13	PTW blocking feeder lane	1	0	1
07:18	7-8 PTW filling reservoir	0	0	0
07:27	4 cyclists blocking feeder lane	0	2	2
07:29	PTW blocking feeder lane	1	0	2
07:30	PTW blocking feeder lane	0	1	2
07:34	PTW blocking feeder lane	1	0	2
07:45	PTW blocking feeder lane	1	1	2
07:46	PTW blocking feeder lane	2	3	9
07:56	PTW blocking feeder lane	3	2	4
07:59	PTW blocking feeder lane	0	1	1
08:01	PTW blocking feeder lane	0	0	1
08:13	PTW blocking feeder lane	0	2	3
08:26	PTW blocking feeder lane	2	1	5
08:28	PTW blocking feeder lane	0	0	1
08:33	PTW blocking feeder lane	1	1	2
08:35	PTW blocking feeder lane	0	2	3
08:38	PTW blocking feeder lane	0	0	2
08:43	PTW blocking feeder lane	1	2	2
08:44	PTW blocking feeder lane	0	2	5
08:47	PTW blocking feeder lane	0	0	2
08:48	PTW blocking feeder lane	0	4	3
08:51	PTW blocking feeder lane	1	0	2
08:54	PTW blocking feeder lane	0	2	4
08:58	PTW blocking feeder lane	0	0	4
09:01	PTW blocking feeder lane	1	1	1
09:05	PTW blocking feeder lane	0	0	5
09:11	PTW blocking feeder lane	2	1	3
09:15	PTW blocking feeder lane	0	0	2

Time	Reason for over capacity	Total Cyclists sitting in advance of reservoir	Total Cyclists sitting in reservoir	Cyclists waiting outside reservoir
09:17	PTW blocking feeder lane	0	0	1
09:28	PTW blocking feeder lane	0	0	2
09:33	PTW blocking feeder lane	0	0	1
16:34	PTW blocking feeder lane	0	0	1

7.24 Based upon the analysis, it can be said that capacity was not a problem regarding the operation of the part width reservoirs or standard ASL sites. However, the obstruction of access to the reservoir was a problem, particularly where large numbers of PTWs were present.

Table 7.3 – Average Number of Cyclists Waiting in Reservoir per Red Phase

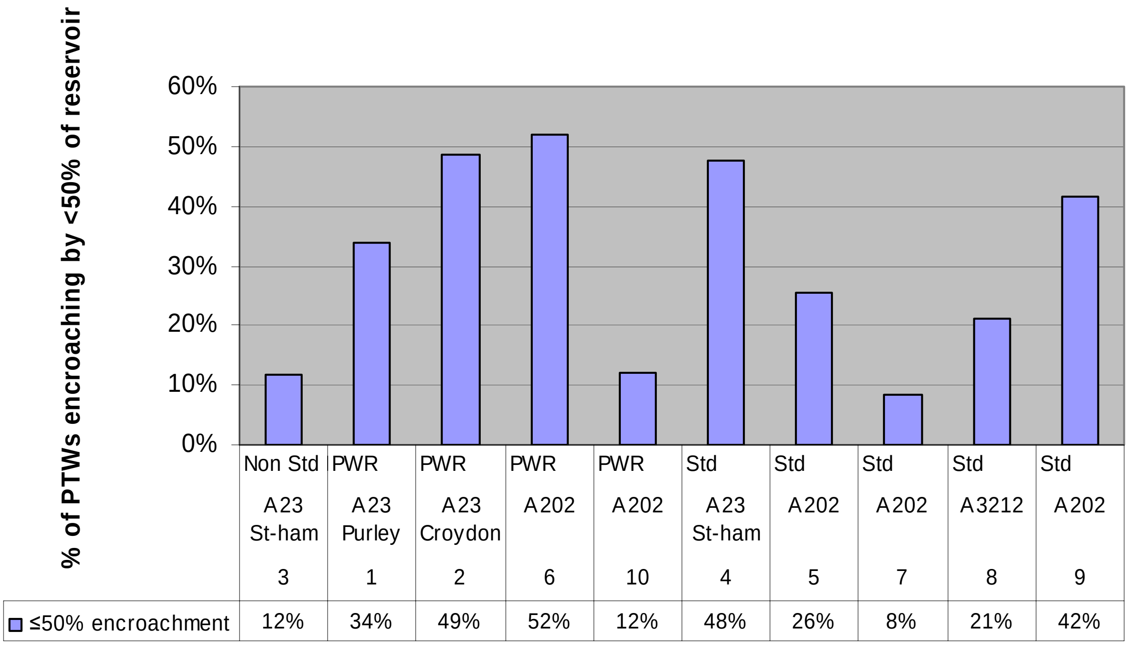
Site number	Number of red phases in peak hour	Maximum hourly cycle flow	Number arriving at red signal	Percentage that stop in the reservoir	Average number stop in reservoir per phase	Average number if all cyclists waited in ASL
1	36	9	3	28%	0.0	0.1
2	45	8	3	20%	0.0	0.1
3	37	35	9	28%	0.1	0.2
4	39.5	14	12	27%	0.1	0.3
5	38	126	55	22%	0.3	1.4
6	35	50	15	6%	0.0	0.4
7	34.5	65	15	24%	0.1	0.4
8	30	119	90	33%	1.0	3.0
9	31	57	28	36%	0.3	0.9
10	41	53	27	20%	0.1	0.7

7.25 The above table helps to explain why over-capacity of the part-width reservoir was generally not a problem. Even where cycle flows were relatively high (e.g. at sites 5 and 9), the average number of cyclists waiting in the reservoir per red phase was one or less. Had all cyclists used ASLs in the correct way (i.e. waited in the reservoir), this number would still have only risen to a maximum of 3. To test the capacity of part-width reservoirs more meaningfully, you would need considerably higher cycle flows, perhaps in the region of 250-300 per hour, which would be relatively hard to find in London apart from on some of the river crossings.

Influence of Powered Two Wheelers in Bus Lanes

7.26 PTWs are permitted to use the bus lane along the A23 between Streatham and Brixton. Sites 3 and 4 are located on the A23 near this area. Figure 7.3 summarises the proportion of PTWs that encroached by less than 50% into the reservoir length.

Figure 7.3 – PTWs Encroaching by ≤ 50% of Reservoir Length



7.27 In terms of PTW encroachment, Site 4 performed better than seven of the other sites. Conversely, Site 3 was at the other end of the scale, with seven other sites performing better. However, Site 3 had a non-standard layout and therefore the results are somewhat inconclusive.

7.28 From this small sample, there does not appear to be a relationship between levels of PTW encroachment and the experimental scheme which allowed PTWs to use bus lanes. However, the sites for this study were not chosen with the experimental PTW bus lane scheme in mind. Further research would, therefore, be needed to determine conclusively whether permitting PTWs to use bus lanes influences their behaviour at ASLs.

VIRTUAL CYCLE LANES

7.29 The feeder lane encroachment figures are summarised in Table 7.4. This shows the width of the feeder lane and nearside lane, along with the percentage of vehicles which encroached into the feeder lane by less than one third of the lane width. A high proportion of vehicles encroaching to this degree, therefore, indicates that the feeder lane was more frequently available for cyclists to use providing a better level of service.

7.30 A third of the feeder lane width was selected because it was felt that, when encroachment is greater than a third, it will become difficult for cyclists to undertake vehicles in the adjacent lane and access the junction.

7.31 Site 3 had no feeder lane and there is, therefore, no data relating to encroachment.

Table 7.4 – Summary of Feeder Lane Encroachment (sorted by combined width)

Site	Feeder Lane Type	VCL or ACFL width	Nearside lane width	Combined	Percentage of vehicles encroaching ≤ ⅓ of feeder lane					
					All day		Peak hour		Off peak	
					All vehs.	Excl. wide vehs.	All vehs.	Excl. wide vehs.	All vehs.	Excl. wide vehs.
3	Stub	0m	3.0m	3.0m	-	-	-	-	-	-
10	VCL	1.2m	1.8m	3.0m	73%	93%	74%	88%	72%	98%
6	VCL	0.9m	2.2m	3.1m	51%	86%	66%	100%	51%	84%
1	VCL	1.2m	2.3m	3.5m	100%	100%	100%	100%	100%	100%
5	ACFL	1.2m	2.45m	3.65m	80%	98%	50%	100%	85%	100%
4	ACFL	1.2m	2.9m	4.1m	99%	100%	100%	100%	100%	100%
8	ACFL	1.2m	2.9m	4.1m	99%	99%	97%	97%	99%	100%
9	ACFL	1.2m	3.0m	4.2m	98%	99%	100%	100%	98%	97%
2	ACFL	1.5m	2.8m	4.3m	100%	100%	100%	100%	100%	100%
7	VCL	1.5m	4.4m	5.9m	97%	97%	100%	100%	97%	97%

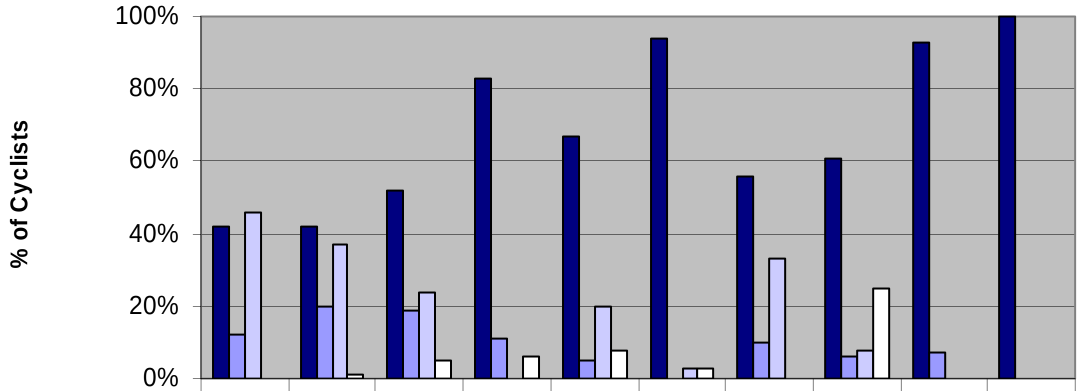
7.32 This table indicates that the standard feeder lanes tended to have less encroachment than the virtual ones. This finding is entirely as expected. Standard feeder lanes are, by definition, used when there is enough width for a conventional adjacent traffic lane (of at least 2.5m wide, or 3.7m including the cycle lane). Site 1 has a virtual cycle lane but a relatively generous total width of 3.5m which is likely to explain the low levels of encroachment at this site.

7.33 Sites 6 and 10 have total lane widths of just 3.1m and 3.0m respectively which is likely to explain the higher levels of encroachment. The virtual cycle lane at Site 6 was marked out at just 0.9m which could explain why, despite a wider total lane width, it had higher encroachment than Site 10 (which had a 1.2m feeder lane width).

7.34 Figure 7.4 summarises the ease with which cyclists were able to access the reservoir. The sites have been sorted from the narrowest (Sites 3 and 10) on the left, to the widest (Site 7) on the right.

7.35 The classification, 'some difficulty', includes situations such as where the cyclist needed to put a foot down on the approach to the junction, or had to change their location within the approach lane. 'Blocked or changed route' includes situations where the cyclist approached the junction in one lane but had to change lanes to pass a motor vehicle, or was unable to access the junction at all. 'Access via alternative' is typically via the footway. A high proportion of cyclists accessing the junction via an alternative route suggests that the usual cycle route is expected to be difficult, slower or more unsafe and they have adapted their route accordingly.

Figure 7.4 – Reservoir Access



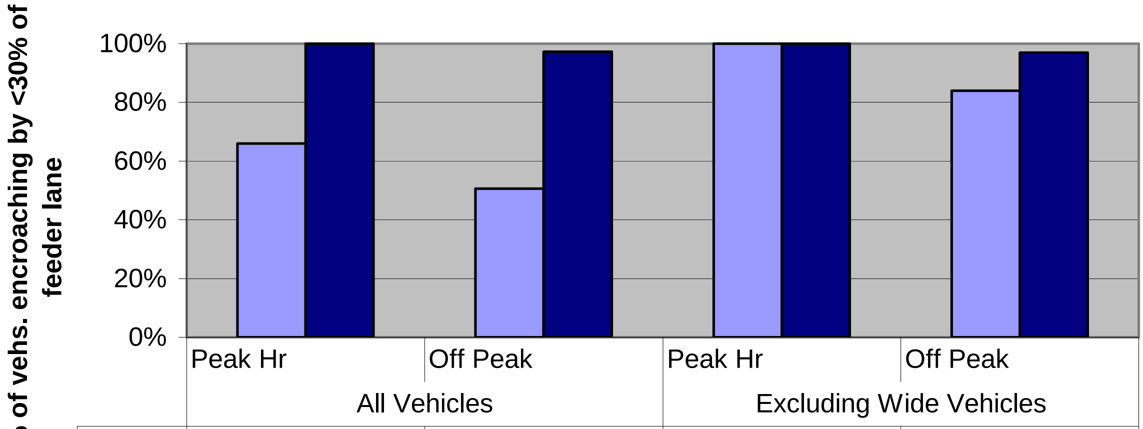
	Site 3	Site 10	Site 6	Site 1	Site 5	Site 4	Site 8	Site 9	Site 2	Site 7
■ Easy Access	42%	42%	52%	83%	67%	94%	56%	61%	93%	100%
■ Some Difficulty	12%	20%	19%	11%	5%	0%	10%	6%	7%	0%
□ Blocked/ Changed Route	46%	37%	24%	0%	20%	3%	33%	8%	0%	0%
□ Access via Alternative	0%	1%	5%	6%	8%	3%	0%	25%	0%	0%

7.36 Figure 7.4 indicates that ease of access increases with lane width. The standard feeder lane sites (2,4,5,8,9) all performed relatively well. The two virtual feeder lane sites which also provided high levels of easy access (1,7) both had relatively generous dimensions.

Assumption D: Higher cycle flows may reduce vehicle encroachment into VCLs

7.37 Sites 7 and 6 were selected for testing this assumption. These sites were selected because they both have VCLs and high cycle flows during peak periods and are of similar width. A summary of the results can be seen in Figure 7.5.

Figure 7.5 – Vehicles Encroaching by ≤ 33% of the Feeder Lane Width at High Cycle Flow Sites



	All Vehicles – Peak Hr	All Vehicles – Off Peak	Excluding Wide Vehicles – Peak Hr	Excluding Wide Vehicles – Off Peak
Site 6	66%	51%	100%	84%
Site 7	100%	97%	100%	97%

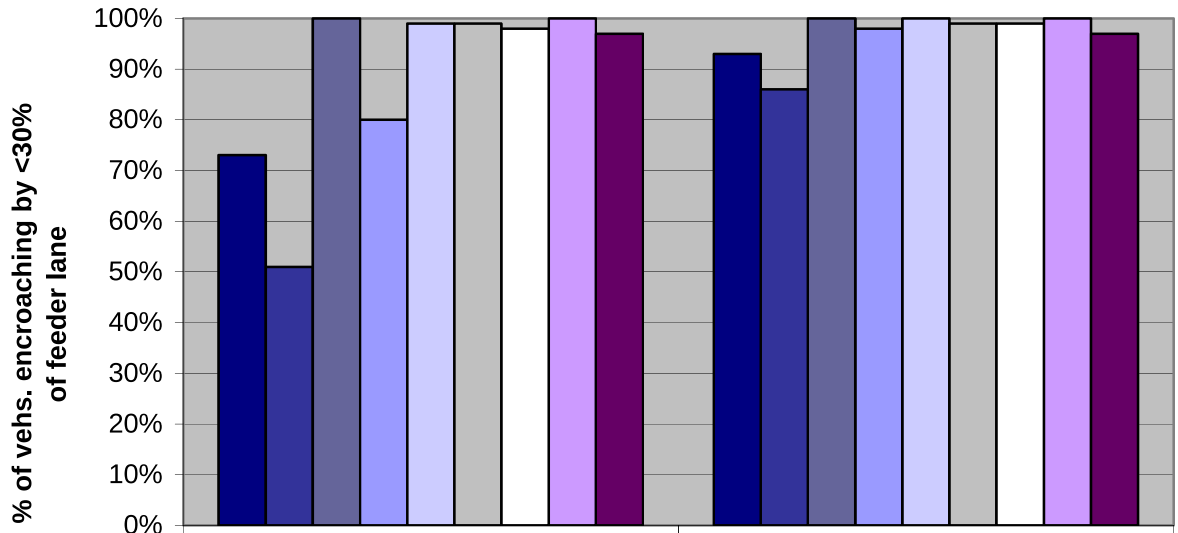
7.38 Figure 7.5 shows that, for the sites involved, fewer vehicles encroached on the feeder lane during the off peak periods.

7.39 The data supports the assumption that higher cycle flows may reduce vehicle encroachment into VCLs. This is the case when wide vehicles are excluded as well as when all vehicles are considered.

Assumption E: Nearside lane width influences the level of encroachment into the VCL

7.40 Figure 7.6 shows the percentage of vehicles that encroached by less than a third into the feeder lane. The sites are sorted by nearside lane width, with the narrowest at the top and the widest at the bottom.

Figure 7.6 – Vehicles Encroaching by ≤ 30% of the Feeder Lane Width at Sites with Similar Lane Widths



	All Vehs.	Excl. Wide Vehs.
10 VCL 3.0m	73%	93%
6 VCL 3.1m	51%	86%
1 VCL 3.5m	100%	100%
5 ACFL 3.65m	80%	98%
4 ACFL 4.1m	99%	100%
8 ACFL 4.1m	99%	99%
9 ACFL 4.2m	98%	99%
2 ACFL 4.3m	100%	100%
7 VCL 5.9m	97%	97%

7.41 When all vehicles are considered, the two narrowest sites (6 and 10) had far fewer vehicles staying out of the feeder lane, with 51% and 73% of vehicles (respectively) encroaching between 0 and 30% of the width of the feeder lane. This compares with 97% to 100% at all other sites (with the exception of Site 8).

7.42 The proportion of wide vehicles is likely to influence the degree of feeder lane encroachment. It is useful, therefore, to also consider the results without wide vehicles. When wide vehicles are excluded, all sites have (up to 33%) encroachment levels of at least 97% except the two narrowest sites (6 and 10) which again did not perform as well with 86% and 93%.

7.43 The statistical analysis undertaken indicated that, when all vehicles are considered, lane width may be a factor in influencing the level of encroachment in the feeder lane. When wide vehicles are excluded, the statistical tests cannot conclusively identify a significant difference.

CONFLICT

7.44 Table 7.5 summarises the conflict data from each of the 10 sites. The location of the conflicts is shown in Appendix C.

Table 7.5 – Summary of conflict

Site	Discomfort	Minor conflict	Major conflict	Collision	Total conflict	Cycle flows	Conflict per cyclist
1	0	0	0	0	**0**	60	0%
2	0	1	0	0	**1**	60	2%
3	0	0	0	0	**0**	264	0%
4	1	0	0	0	**1**	48	2%
5	1	1	1	0	**3**	832	0%
6	5	3	1	0	**9**	518	2%
7	0	0	0	0	**0**	508	0%
8	5	4	0	0	**9**	822	1%
9	3	0	0	0	**3**	502	1%
10	7	0	1	0	**8**	388	2%
Total/average					**34**	**400**	**1%**

7.45 In total, 34 conflict incidents were recorded. The large majority of these were 'discomfort' incidents where the cyclist did not have to change speed or direction but simply was put in an uncomfortable situation. Most of the discomfort and minor conflicts took place at Sites 6, 8 and 10.

7.46 At Sites 6 and 10, the main problem appeared to be when wide vehicles blocked the feeder lane and cyclists overtook queuing traffic in the outside lane (or sometimes in the oncoming lane). They would then have to weave their way back into the nearside lane when the green phase began which could involve a fairly difficult or uncomfortable manoeuvre.

7.47 The main source of conflict at Site 8 was traffic turning left in front of cyclists into Bessborough Gardens, and PTWs passing very close to cyclists as they cycle across the junction in the LAJ.

7.48 Four minor conflicts took place at Site 4 on the main road. However, this was not the approach being studied. These incidents appeared to be caused by cyclists on the footway (making use of the pelican crossing against the signals) crossing the road as vehicles pulled out of the side approach arm. As these incidents did not occur on the approach being investigated, they are not included within Table 7.5.

7.49 There was a total of three major conflicts. At Site 5 it involved a 'near miss' between two cyclists; one of whom had gone through the junction on a red signal. At Site 6 it involved a cyclist attempting to reach the nearside lane after approaching the ASL in the outside lane (as the feeder lane was blocked). At Site 10 it involved a cyclist in the LAJ and a motorist immediately outside the LAJ passing within centimetres of each other.

7.50 The small number of recorded conflicts prevented the use of statistical analysis. It is not, therefore, possible to say whether the layout of the experimental facilities had an impact on the amount of conflict.

LANE ACROSS JUNCTION

Assumption G: A Lane Across the Junction reduces conflict at pinch points on exit arm

7.51 Conflict can be influenced by many factors, including traffic volumes and types, and lane widths. For this reason it was felt that the focus should be on two approaches (Site 8 and Site 9) which were at the same junction. The two approaches had similar cycle flows and lane width configurations. However, Site 8 had considerably more PTWs.

7.52 The conflict data at the junction exit points for both approaches indicates that three incidents occurred. All were graded as discomfort incidents.

7.53 Whilst verifying the recorded conflict, it was observed that cyclists entering the exit arm pinch point appeared to look over their shoulders much more often on the site without an LAJ than the site with an LAJ. This suggests that the LAJ gives cyclists a feeling of confidence that they have a defined space when entering the exit arm and they do not need to perform the (potentially dangerous) manoeuvre of looking behind them as they enter a pinch point. However, it could be suggested that the LAJ provided a false sense of confidence. This issue could be covered in further research.

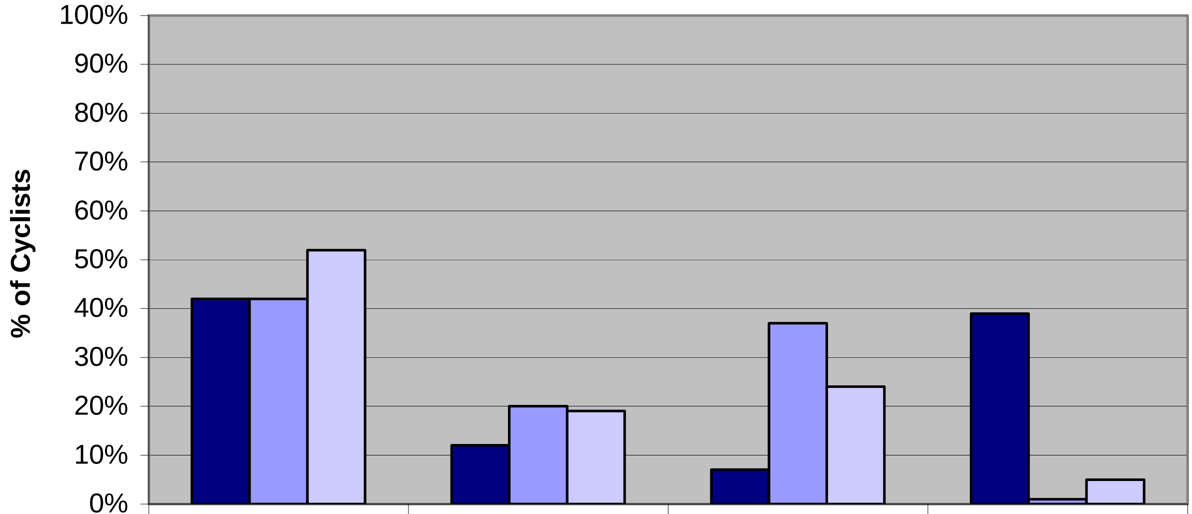
7.54 There was a very small number of conflicts recorded at the exit arm pinch points preventing this assumption from being tested. However, anecdotal observations suggested that cyclists approaching the exit arm pinch point without an LAJ were more likely to look over their shoulder indicating higher levels of uncertainty, discomfort and perceived danger.

GATE ENTRIES

Assumption H: Access by gate is not as easy as by VCL

7.55 This assumption can be tested using the 'ease of access' data for Site 3, which has a lane width of 3.0m, and comparing it with Sites 10 and 6, which have similar lane widths of 3.0m and 3.1m respectively. This is shown in Figure 7.7.

Figure 7.7 – Comparing 'Ease of Access' Between Gated and VCL Sites



	Easy Access	Some Difficulty	Blocked/ Changed Route	Access via Alternative
Site 3	42%	12%	7%	39%
Site 10	42%	20%	37%	1%
Site 6	52%	19%	24%	5%

7.56 Figure 7.7 indicates that the access by gate was considered to be 'easy' at a similar frequency as the VCL sites. However, it can be seen that 39% of cyclists at the gate site (3) accessed the reservoir by an alternative route compared with up to 5% at the two VCL sites. With no formal feeder lane and restricted lane widths preventing access to the reservoir at Site 3, many cyclists left the carriageway and approached the junction on the footway.

7.57 Based upon the data comparing the gate site with two VCL sites of similar width, it appears that access by gate is not as easy as by VCL. In other words, the VCLs appear to provide a key advantage over the gate entries in enabling the cyclists to reach the front of the queue.

IMPACT OF THE NUMBER OF APPROACH LANES ON CONFLICT

7.58 Three of the ten sites (sites 2, 8 and 9) had three or more approach lanes. Only Site 2 had an above-average conflict rate but this equated to only one conflict incident (cycle flows were low at this site). The other two sites had an average level of conflict. One of the conflicts at Site 8 took place when a cyclist attempted to cross the multiple lanes of traffic to turn right (from the feeder lane) as the green signal phase began. This conflict could, therefore, be related to the impact of a multi-lane approach. However, the ASL reservoir and feeder lane were the standard layout at this site so this would appear to be a general ASL issue rather than something specifically linked to the experimental facilities. The minor conflict at Site 2 also related to a cyclist trying to cross several lanes (from the offside to the nearside) as the green phase began. The approach to this ASL, however, was also a standard layout (advisory cycle lane).

COMPARISONS WITH THE TRL STUDY

7.59 The TRL study, '*Behaviour at Cycle Advance Stop Lines'* carried out in 2002 on behalf of TfL, investigated the use of standard layout ASLs by cyclists. The study found that 1.2% of all surveyed cyclists were involved in a conflict, including 0.1% in a serious conflict. The cyclists monitored in this ASL Variations study had a 0.9% conflict rate with a serious conflict rate of 0.1%; both figures roughly in line with the TRL results.

7.60 The TRL study found that 18% of cyclists violated a red light. This ASL variations study, however, found an average red light violation rate of 36%. The difference in these figures is considerable and may justify further investigation to determine which is more representative of typical London cyclists.

8. Conclusions and recommendations

CONCLUSIONS

General

8.1 These conclusions relate to a study carried out at 10 sites on the A202 and A23 in London between Westminster and Peckham, and Streatham and Purley. The new facilities ('virtual' cycle lanes, part width advanced stop line reservoirs, and cycle lanes across signalised junctions) were put in over the summer of 2004 and the surveys for this research took place between November 2004 and January 2005.

8.2 It was found that relatively few cyclists used the reservoirs (both standard layout and experimental design) in the intended manner. Only around a quarter of cyclists who arrived at a red signal waited in the reservoir. The remainder either waited in advance of the reservoir or crossed all (or part of) the junction during the red phase.

8.3 Encroachment into ASL reservoirs by powered two wheelers (PTWs) was very high at all sites (on average PTWs were encroaching into at least half the reservoir 60% of the time compared with just 14% of the time for car traffic). In some situations (but only noted with the full-width reservoirs), PTWs prevented cyclists from accessing the ASL reservoir.

Part Width Reservoirs (PWRs)

8.4 PWRs do not appear to have capacity problems (with the number of cyclists observed at the survey sites). This is likely to be influenced by the observation that only a minority of cyclists stopped in the reservoirs when arriving at a red signal. When using ASLs, many cyclists choose to wait on the nearside with one foot on the kerb. This is likely to be more comfortable (and stable) than waiting in the middle of the reservoir where they would have to either come off the saddle or balance using their toes. If cycle flows continue to increase in the future, an increased reservoir depth may, therefore, be of more assistance to cyclists than an increased width. Only one of the ten sites had a capacity problem (where large numbers of PTWs blocked access to the reservoir) but this involved a full-width reservoir.

8.5 PWRs appear to have less encroachment than conventional full-width reservoirs (when allowances are made for unusual sites). 66% of vehicles encroach have minimal encroachment in standard reservoirs at peak hour whereas 80% have minimal encroachment into the part-width reservoirs. Low levels of encroachment were recorded at both Inner London sites, with high levels of cycling, and Outer London sites with much lower levels of cycling.

8.6 Based upon the data provided, there is no evidence to support the assumption that higher cycle flows may reduce vehicle encroachment into PWRs. At one of the two sites analysed for this assumption, encroachment worsened by 1% in the off-peak (when cycle flows are low) but at the other site, encroachment improved by 15%.

Virtual Cycle Lanes (VCLs)

8.7 Current TfL policy is to provide a formal feeder lane into a reservoir only when there is adequate width. This is an absolute minimum lane width of 3.5m (1.0m cycle lane and 2.5m general traffic) but the preferred minimum is 4.5m (1.5m cycle lane and 3.0m general traffic lane). The results of this study suggest that virtual cycle lanes provide an opportunity to install a cycle facility in traffic lanes as narrow as 3.0m (with 1.2m for the virtual feeder lane and 1.8m for the general traffic lane).

8.8 Great care must be taken when marking out VCLs (as with all experimental cycle facilities). They should be at least 1.2m wide. However, the Site 6 feeder lane was measured at just 0.9m (although they were specified to be marked at least 1.2m wide) and this seemed to make it considerably harder for cyclists to access the reservoir.

8.9 The data seems to support the assumption that higher cycle flows may reduce vehicle encroachment into VCLs. This is the case when wide vehicles are excluded as well as when they are not.

8.10 The statistical analysis indicated that, where all vehicles are considered, lane width may be a factor in influencing the level of encroachment in the feeder lane (the wider the nearside lane, the less encroachment into the virtual cycle lane). When wide vehicles are excluded, the statistical tests did not conclusively identify a significant difference.

General Conflict

8.11 Less than 1% of all cyclists were involved in a conflict incident. This is a similar figure to the level of conflict recorded in the 2004 TRL study into a variety of sites in London.

8.12 The main causes of conflict included;

- cyclists accessing the reservoir from an outside lane and having to cut back into the nearside lane as the signals changed to green;
- cyclists in the LAJ being passed very closely by powered two wheelers and cars;
- cyclists crossing the junction during a red phase.

Lanes Across Junctions (LAJs)

8.13 The impact of LAJs was hard to quantify objectively from video footage due to the number of conflict incidents. It is likely that the main benefit relates to cyclist comfort and perceived safety which can only be reliably measured by questionnaire surveys.

8.14 Where there was no cycle lane across the junction, cyclists were observed looking over their shoulders at the exit-arm pinch-point which is likely to impact on their level of comfort, and both perceived and actual safety.

Gate Entries

8.15 Based upon the data comparing the gate site with the two VCL sites of similar width, it appears that VCLs provide cyclists with a considerable advantage in legally accessing ASL reservoirs.

8.16 The gate site (Site 3), which had no feeder lane but for which a VCL was planned, clearly showed that many cyclists were unable to reach the reservoir and therefore mounted the footway to bypass queuing traffic.

DESIGN RECOMMENDATIONS

8.17 The following recommendations are based upon investigation of the 10 sites and the subsequent analysis and findings discussed in this report. The experimental measures should not be applied without appropriate consideration of the factors specific to the site being considered. Furthermore, while the conflict data obtained during this study did not identify any negative impacts as a result of the experimental measures, this data was obtained over a relatively brief period of time. Further monitoring should, therefore, be maintained in order to respond quickly to emerging trends in safety and amenity.

8.18 Part-width reservoirs (PWRs) should be considered in preference to ASLs on approaches without a right turn. This is because PWRs appear to encourage motorists to stop outside of the reservoir and create more space for cyclists. Furthermore, while the layout of PWRs results in less physical space available for cyclists due to the reduced total reservoir width, this did not result in cycle numbers exceeding capacity at any of the sites investigated. As previously mentioned, many cyclists tend to keep to the nearside of the ASL reservoir. The depth of the reservoir may therefore be of greater importance if cycle flows continue to increase.

8.19 VCLs should be considered in addition to gate access on nearside traffic lanes which are between 3.0 metres and 3.5 metres wide. This is because they appear to provide better access for cyclists into the reservoir than just a gate entry, without any apparent reduction in safety. Where the nearside lane width is at least 3.5m, an advisory cycle lane can be provided (1.0m wide with adjacent 2.5m all-traffic).

8.20 The data obtained during this study is inconclusive as to whether LAJs help cyclists to negotiate junctions more easily and safely than where no LAJs are present. The number of conflicts was too small in both cases to allow the use of statistical tests. Observations indicate that cyclists using LAJs are less likely to look over their shoulder at the pinch point exiting the junction. This suggests that LAJs can improve the perceived level of safety for cyclists but it is not known whether this equates to an increase in actual safety. Further trialling and monitoring of LAJs is recommended.

8.21 Several close manoeuvres were observed between cyclists in the LAJ and motor vehicles in the adjacent lane. It is recommended, therefore, that LAJs have a minimum width of 1.5m. The use of hatching to segregate the cycle lane from the all traffic lane could also be considered.

8.22 Where high numbers of PTWs and cyclists make use of the same junction, there is a risk that cyclist access to the junction will be blocked by PTWs. Design alterations to address this issue should also be considered in addition to education initiatives. Such alterations may include the provision of additional width on the feeder lane. A deeper reservoir (e.g. 5m instead of 4m) would also enable some PTW users to clear the feeder lane entrance and should therefore be the standard dimension. However, the main problem appears to be caused by the misuse of the feeder lane by PTWs.

RECOMMENDATIONS FOR FUTURE WORK

8.23 One of the key findings from this research has been that relatively few cyclists use ASLs in the intended way (i.e. waiting in the reservoir when the lights are red). It would be useful to understand why this is the case i.e. whether it is a misunderstanding of how to use an ASL, whether it is a reaction to the misuse of ASLs by other vehicles, particularly PTWs, or some other reason. What problems are caused by the misuse of ASLs by cyclists? Is an education/awareness-raising initiative required?

8.24 The proportion of cyclists that violated a red signal varied markedly between this study and the TRL study *'Behaviour at Cycle Advance Stop Lines'*. Which figure is representative of the typical London cyclist and what are the safety (and other) implications of habitual red-light violation by cyclists? Which factors are influencing cyclists' decisions to ignore a red light?

8.25 PTWs were observed using ASL reservoirs on a wide scale. Can their misuse of ASLs be effectively enforced? Can their widespread use of ASLs be legally accommodated through a new layout? Does permitting PTWs to use bus lanes encourage them to misuse ASLs? What is the effect on capacity, speed, comfort and safety of PTW encroachment? Studies could also be conducted to establish whether the proportion of PTWs waiting in ASL reservoirs is higher than the proportion of PTWs waiting ahead of the stop line on a non-ASL junction.

8.26 Although PTWs encroached onto the ASL reservoirs considerably more than other vehicles, many cars also habitually encroach. It should also, therefore, be considered whether their misuse can be effectively enforced, or whether different layouts (perhaps with clearer signage) can improve motorist compliance.

8.27 At the time of writing, there were plans to install a VCL at Site 3. After implementation, research could be carried out to compare the results with the 'before' situation as covered in this report. This would help to identify the impact of a VCL on reservoir access for cyclists and the positioning of motor vehicles.

8.28 It is recommended that further research is carried out into the use of LAJs. It would be useful to conduct observations of left-turning conflicts at sites with and without LAJs (or, given the difficulty of finding directly comparable sites, a 'before and after' study at the same junction) – to determine whether there is more conflict with or without the LAJ, the extent of any confusion about priority on these lanes, and passing distances. It was also observed, anecdotally, that cyclists on LAJs tended not to look over their shoulders at the exit-arm pinch points as much as cyclists at junctions without LAJs. An observation of this behaviour could be used in future research as a useful indicator of cyclist discomfort and perception of danger. Design criteria should also be established to determine where LAJs are most appropriate (this is likely to be related to the size of the junction and the width of the exit-arm pinch point).

8.29 A questionnaire survey at a site with an LAJ would provide a better understanding of cyclists' level of comfort and perceived safety. Cyclists could be provided with a plan showing the facility and asked to highlight any problem areas and to explain any differences in comfort, safety, journey time or any other factor, as a result of the new facility. A high sample of cyclists would be essential for such a survey (Site 8/Site 9 would appear to provide an ideal location).

8.30 It is recommended that a collision analysis is carried out (with more sites over a longer period of time) and that all sites are monitored using the TfL Traffic Accident Diary System.

9. 'Before and After' survey

9.1 Transport for London commissioned Faber Maunsell to carry out a study on the cycling conditions before and after the implementation of the new facilities described in this report. The study comprised the following surveys:

- Cycle counts
- Journey time surveys (along the corridors)
- Attitudinal surveys (at the new-layout junctions)
- Aggregated accident data for the corridors (before survey only)

9.2 For more information on the above surveys, see the project report (A23&A202 ASL Before & After study: June 2005).

SUMMARY FROM 'BEFORE AND AFTER' REPORT

9.3 Cycle flows were higher on the A202 than the A23. The number of cyclists was higher in the 'after' cycle count than in the 'before' on the A202. At the A23 sites, some cycle flows had increased in the 'after' count and some had decreased. Overall, cycle flows at the 'before and after' sites were 27% higher in the after count.

9.4 Cyclists in the 'before' survey were satisfied with conditions on the A202 but those on the A23 were less satisfied. Both sets of cyclists highlighted safety and journey times as a concern.

9.5 In the after survey, average satisfaction levels had increased from 3.2 to 3.7 out of 5 (although this masks a decrease at one site; Pomeroy Street).

9.6 Most of those interviewed were frequent commuter cyclists. Average trip distances were approximately 5 miles.

9.7 The new facilities appear to have had no discernible impact on journey times (according to both respondent feedback and B&A journey times surveys)

9.8 Part-width reservoirs received the most positive response.

9.9 Virtual lanes and part-width reservoirs were considered useful or extremely useful by the majority of cyclists. However, many respondents felt that the lanes were too narrow (resulting in motor vehicle encroachment) or too short.

9.10 The new facilities appear to have improved cyclist perception of safety and comfort rather than journey time and reliability.

9.11 The respondents felt that each of the new facilities was better than nothing. The usefulness of the part-width reservoirs was considered only slightly lower than for the full-width ones (however, the sample size for full-width reservoirs was small).

RECOMMENDATIONS FROM 'BEFORE AND AFTER' REPORT

9.12 The perception of the new facilities was positive. It is recommended that they are implemented where suitable junctions exist. However, before implementation, the unique characteristics of the junction must be taken into account.

9.13 Where the road layout allows, advisory or mandatory feeder lanes should be used. Where this is not possible, virtual lanes should be provided with greater lengths (than seen in this study) if possible.

9.14 Part-width reservoirs are recommended at junctions where there is no right turn.

9.15 LAJs should only be provided where there is sufficient width for a cycle lane and an all traffic lane.

9.16 Collision reviews should be carried out 12 months after implementation (October 2005) prior to a full assessment after 3 years (October 2007).

9.17 At the same time as the collision reviews, it is recommended that cycle counts and, possibly, user attitudinal surveys are repeated at the locations in the study. It would be useful to investigate whether cyclists' attitudes towards the newly implemented cycle facilities alter over time, as the facilities become longer established.

10. Joint Summary of Conclusions and Recommendations

10.1 This summary relates to two studies carried out at a number of sites on the A202 and A23 in London between Westminster and Peckham, and Streatham and Purley. New facilities ('virtual' cycle lanes, part-width advanced stop line reservoirs, and cycle lanes across signalised junctions) were implemented over the summer of 2004 and the surveys for this research took place between spring 2004 and spring 2005.

10.2 This chapter combines the findings from the 'Conflict and Encroachment' report and the 'Before & After' study briefly described in the previous chapter, to provide a set of overall findings. Each paragraph covers a separate design feature.

'Virtual' cycle lanes (green surfacing with cycle symbols)

10.3 The 'Before & After' study found that virtual cycle lanes (VCLs) were considered to be useful, or extremely useful, by the majority of cyclists. The conflict and encroachment study (i.e. the main body of this report) also found that the VCL provided cyclists with a considerable advantage in accessing ASL reservoirs when compared with a gate entry. Although most wide vehicles were unable to keep out of the VCL (due to the width of the adjacent all traffic lane) most of the cars, and other narrow vehicles, respected the lane despite the lack of formal lane markings. This enabled cyclists to pass stationary traffic and reach the ASL reservoir, when without the VCL, it is likely that they would not have been able to.

10.4 It was recommended that VCLs should be considered in addition to gate access on nearside traffic lanes which are between 3.0 metres and 3.5 metres wide. This is because they appear to provide better access for cyclists into the reservoir than just a gate entry without any apparent reduction in safety. Where the nearside lane width is at least 3.5m an advisory cycle lane can be provided (1.0m wide with adjacent 2.5m all-traffic).

Part-width reservoirs (PWRs)

10.5 Part-width reservoirs (PWRs) were considered useful or extremely useful by the majority of respondents (to the 'Before & After' study), and received the most positive response of all the new layout features. The conflict and encroachment study also produced favourable results for the part-width reservoirs. After allowances for unusual sites had been made, PWRs had less encroachment than conventional reservoirs. There were no recorded capacity problems although this was likely to have been partly due to the fact that a) only a minority of cyclists actually waited in the reservoir when the signals were red (most waited in advance of the cyclist stop line or did not stop at all) and b) cycle flows were relatively low (the highest average daily flow was around 250 at the PWR sites).

10.6 Part-width reservoirs (PWRs) should be considered in preference to ASLs on approaches without a right turn. This is because PWRs appear to encourage motorists to stop outside of the reservoir and create more space for cyclists. Furthermore, while the layout of PWRs results in less physical space available for cyclists due to the reduced total reservoir width, this did not result in cycle numbers exceeding capacity at any of the sites investigated. Many cyclists tend to keep to the nearside of the ASL reservoir. The depth of the reservoir may therefore be of greater importance if cycle flows continue to increase.

Lane across the junction (LAJ)

10.7 The respondents to the 'Before & After' survey gave 'generally positive' feedback about the cycle lanes across junctions (LAJs) although they were less positive about them than the other new features. This study concluded that they should only be provided where there is enough room for a cycle lane and an 'all traffic' lane. The conflict and encroachment study found insufficient conflict incidents for statistical analysis, and concluded that the main benefits were likely to be to cyclists' perceived comfort and safety. The main advantage of an LAJ is generally thought to be that they provide guidance for cyclists on very large signalised junctions. However, the largest junction (Vauxhall Bridge/Millbank), where LAJs are likely to provide the greatest benefit, was not covered in the 'Before & After' study, and it was recommended that future qualitative research included such sites. It was also observed (anecdotally) that, at sites without LAJs, cyclists appeared to look over their shoulder at the exit arm pinch point (perhaps indicating uncertainty and a lower level of perceived safety).

10.8 The data obtained during this study is inconclusive as to whether LAJs help cyclists to negotiate junctions more easily and safely than where no LAJs are present. There was no evidence to indicate that the level of conflict increased as a result of the LAJs. Observations indicate that cyclists using LAJs are less likely to look over their shoulder at the pinch point exiting the junction. This suggests that LAJs can improve the perceived level of safety for cyclists but it is not known whether this equates to an increase in actual safety. Further trialling and monitoring of LAJs is recommended.

10.9 Several close manoeuvres were observed between cyclists in the LAJ and motor vehicles in the adjacent lane (this remains an unresolved issue). It is recommended, therefore, that LAJs have a minimum width of 1.5m. The use of hatching to segregate the cycle lane from the all traffic lane could also be considered.

Gate entries

10.10 Based upon the data comparing the gate site with the two VCL sites of similar width, it appears that VCLs provide cyclists with a considerable advantage in legally accessing ASL reservoirs. The gate site, which had no feeder lane but for which a VCL was planned, clearly showed that many cyclists were unable to reach the reservoir and therefore mounted the footway to bypass queuing traffic.

Problems with Powered Two Wheelers (PTWs)

Where high numbers of PTWs and cyclists make use of the same junction, there is a risk that cyclist access to the junction will be blocked by PTWs. Design alterations to address this issue should also be considered in addition to education initiatives. Such alterations may include the provision of additional width on the feeder lane. A deeper reservoir (e.g. 5m instead of 4m) would also enable some PTW users to clear the feeder lane entrance and should therefore be the standard dimension. However, the main problem is likely to be caused by the misuse of the feeder lane by PTWs and it should, therefore, be considered whether their misuse can be effectively enforced.

APPENDIX A SITE LOCATIONS

APPENDIX B CONFLICT DIAGRAMS

APPENDIX C STATISTICAL ANALYSIS

The table below sets out the assumptions tested in this study together with the results and conclusions. For each assumption we are testing the null hypothesis that there is no difference between the percentages measured at test sites and control sites against the alternative hypothesis; the two percentages are different. In each test, the null hypothesis is rejected if the difference between the two percentages is greater than 1.96 times its standard error. This is true if 1.96<test statistic or test statistic <-1.96.

The raw data used for the analysis is presented below followed by the formulae used to derive the test statistics.

Assumptions	Control Site	Test Site	Factors	Test	Result	Conclusion
Part Width Reservoirs						
a) Higher cycle flows may reduce vehicle encroachment into PWRs		10 6	Peak hr vs Off Peak Hr	P1=% encroachment peak hours P2= % encroachment off-peak hours, where '% encroachment' is % of vehicles that encroached between 0-25% into PWR H_0: P1-P2=0	<u>All vehicles</u> P1-P2 = -0.09 S.E (P1-P2) = 0.0254756 Test statistic = -3.498 <u>Without PTWs</u> P1-P2 = 0.04 S.E (P1-P2) = 0.02797401 Test statistic = 1.497	<u>All vehicles</u> There is statistical evidence to suggest a difference in levels of vehicle encroachment into PWRs between peak and off peak cycle times at the 95% confidence level. The negative test statistic implies fewer vehicles encroach more than 25% into the PWRs during off-peak cycle hours – contradictory to the original hypothesis. <u>Without PTWs</u> Since 1.497<1.96, we can conclude there is no evidence to suggest a difference between levels of vehicle encroachment during peak and off-peak hours when excluding PTWs. In other words, although it appears from the

Assumptions	Control Site	Test Site	Factors	Test	Result	Conclusion
						sample that less vehicle encroachment occurred during peak hours (79%<83%), this 4% difference isn't statistically significant.
b) PWR results in less encroachment than standard ASLs	4 5 7 8 9	1 2 6 10	With PTWs Without PTWs	P1=% encroachment test sites P2= % encroachment control sites where '% encroachment' is % of vehicles that encroached between 0-25% into PWR or ASL H_0: P1-P2=0	<u>All vehicles</u> P1-P2 = 0.09 S.E (P1-P2) = 0.0062059 Test statistic = 14.235 <u>Without PTWs</u> P1-P2 = 0.02 S.E (P1-P2) = 0.6199818 Test statistic = 0.0362	<u>All vehicles</u> Overall, there is statistical evidence to suggest that PWRs result in less vehicle encroachment than standard ASLs <u>Without PTWs</u> When excluding PTWs from the analysis no statistical evidence was found to suggest a difference between PWRs and standard ASLs. The overall conclusion is that PWRs are more successful than standard ASLs at stopping PTWs encroach, but are no better or worse than standard ASLs when considering all other vehicle encroachment
					<u>Excluding Site 8 All Vehicles</u> P1-P2 = 0.07 S.E (P1-P2) = 0.0067268 Test statistic: 10.749	<u>Excluding Site 8 All Vehicles</u> Since 10.749>1.96 there is statistical evidence to suggest that test sites are better than control sites at preventing vehicle encroachment.

Assumptions	Control Site	Test Site	Factors	Test	Result	Conclusion
					Excluding Site 8 Without PTWs P1-P2 = 0.06 S.E (P1-P2) = 0.0066907 Test statistic = 8.55	Excluding Site 8 Without PTWs Therefore, since 8.55>1.96 there is still evidence to suggest test sites are better than control sites at preventing vehicle encroachment even when excluding PTWs from the data. So, when Site 8 is included in the analysis, there is no significant difference between test and control sites (excluding PTWs), but when Site 8 is excluded from the analysis there is a significant evidence to suggest test sites are better at preventing vehicle encroachment. i.e. Site 8 was skewing the results. **Caution**: when excluding the PTW data from the analysis it creates a somewhat artificial situation. Some of the cars recorded at 0% encroachment, could in reality have encroached into the reservoirs had the PTWs been absent. This data does, however, give us a "lower bound" on the amount of encroachment by cars were PTWs absent - i.e. a best case scenario, as in reality encroachment would almost certainly be greater than this.

Assumptions	Control Site	Test Site	Factors	Test	Result	Conclusion
c) PWR provides insufficient cycle capacity in the reservoir where cycle flows are high		*With the exception of two instances, no sites had overcapacity issues due to anything other than PTWs blocking access.*				Not required
Virtual Cycle Lanes						
d) Higher cycle flows may reduce vehicle encroachment into VCLs		6 7	Peak hr vs Off Peak hr	P1=% encroachment peak hours P2= % encroachment off-peak hours, where '% encroachment' is % of vehicles that encroached up to 33% into VCL H_0: P1-P2=0	P1-P2 = 0.763 S.E (P1-P2) =0.0433458 Test statistic = 2.164	There is evidence to suggest fewer vehicles encroach more than a 3rd of the way into the VCL in peak cycle hours.

Assumptions	Control Site	Test Site	Factors	Test	Result	Conclusion
e) Nearside lane width influences the level of encroachment into VCL	1	6 10	With wide vehicles Without wide vehicles	P1=% encroachment test sites P2= % encroachment control sites where '% encroachment' is % of vehicles that encroached up to 33.3% into VCL H_0: P1-P2=0	All vehicles P1-P2 = -0.34 S.E (P1-P2) = 0.0133343 Test statistic = -25.208 Excluding wide vehicles P1-P2 = -0.08 S.E (P1-P2) = 0.3054907 Test statistic = -0.276	All vehicles There is evidence to suggest control sites were more successful than test sites at preventing vehicles encroaching more than a third of the way into the VCLs at the 95% confidence level. Excluding wide vehicles When excluding wide vehicles from the analysis no statistical evidence was found to suggest a difference between test and control sites
f) High proportion of HGV increase the level of vehicle encroachment into VCL						Not required
Lane Across Junctions						
g) LAJ reduces conflict at pinch points on exit arm	9	8				Not required

Assumptions	Control Site	Test Site	Factors	Test	Result	Conclusion
Gate entries						
h) Access by Gate is harder than by VCL	3	6 10	*Used only sites with similar widths*	P1 = % access blocked VCL P2 = % access blocked Gate Lane H_0: P1-P2=0	P1-P2 = -0.13 S.E (P1-P2) = 0.0625061 Test statistic = -2.097	There is statistical evidence to suggest that cyclists were blocked fewer times at the Gate Lane site compared to the VCLs at a 95% confidence level.

Assumption a)

All Vehicles		
	Peak (P1)	**Off-Peak (P2)**
0-25%	220	1331
Total	331	1671
%	**71%**	**80%**

Excluding PTW		
	Peak (P1)	**Off-Peak (P2)**
0-25%	1280	201
Total	1630	243
%	**79%**	**83%**

Assumption b)

All Sites – Test Sites (P1)		
	All Vehicles	**Excluding PTW**
0-25%	6866	6663
Total	8694	8127
%	**79%**	**82%**

All Sites – Control Sites (P2)		
	All Vehicles	**Excluding PTW**
0-25%	8294	7810
Total	11825	9794
%	**70%**	**80%**

Assumption b) Excluding Site 8

All Sites – Test Sites (P1)		
	All Vehicles	**Excluding PTW**
0-25%	6266	6663
Total	8694	8127
%	**79%**	**826%**

All Sites – Control Sites (P2)		
	All Vehicles	**Excluding PTW**
0-25%	5512	5306
Total	7683	6951
%	**72%**	**76%**

Appendix d)

All Sites – Test Sites (P1)		
	Off-Peak (P2)	**Peak (P1)**
0-25%	572	93
Total	761	110
%	**75%**	**85%**

Assumption e)

All Sites – Test Sites (P1)		
	All Vehicles	**Excluding Wide Vehicles**
Up to a 3rd	1723	1564
Total	2598	1708
%	**66%**	**92%**

All Sites – Control Sites (P2)		
	All Vehicles	**Excluding Wide Vehicles**
Up to a 3rd	1489	1369
Total	1490	1369
%	**100%**	**100%**

Assumption h)

All Cyclists		
	Test Sites (P1)	**Control Sites (P2)**
Access Blocked	71	37
Total	218	81
%	**33%**	**46%**

Formulae

Standard error (p_1-p_2) = $\sqrt{p(100-p)\left[\frac{1}{n_1}+\frac{1}{n_2}\right]}$

where p= $\frac{n_1 p_1 + n_2 p_2}{n_1 + n_2}$

t = $\frac{p_1 - p_2}{S.E(p_1 - p_2)}$